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CIVIL ENGINEERING.

*Locomotive Boiler Explosion at Sharp, Stewart, & Co.'s Works.**

On reference to our "Notes and Novelties," mention will be found of a fatal boiler explosion which occurred on the premises of Messrs. Sharp, Stewart, & Co., the eminent locomotive builders, Manchester, whilst they were testing the boiler and machinery of an unfinished locomotive engine, and by which the life of the highly talented and much respected manager of the works, Mr. Thomas Forsyth, was sacrificed; as also the lives of several others who were present.

Mr. William Fairbairn having been requested by the coroner to examine the boiler and report thereon, and as to the cause of the accident, has reported at great length, with his usual ability and care; and as his report contains all the more important details concerning the boiler and connected with the accident, we have given it below *in extenso*.

There is one material point with which Mr. Fairbairn has not dealt, although he has slightly alluded to it, which we think deserves especial attention by engineers: we refer to the defects in the practice of punching and riveting plates.

During a discussion which took place some time ago at the Institution of Civil Engineers, Mr. Edward Humphrys, whose extensive practical experience entitles his opinion on any practical scientific question to the highest respect, called attention to the prejudicial effects which arise from the defective construction of punches and bolsters, and from the subsequent employment of the more powerful means of riveting by

*From the London Artizan, August, 1858.

machinery which are frequently adopted. If we remember aright, and our recollection is aided by some remarks which have been made upon this subject by Mr. Charles May, C. E., the observations which were made by Mr. Humphrys to which we allude, went to show clearly enough that the edges of plates prepared for riveting, and afterwards riveted, were very materially weakened from two causes—first, from the punch employed being smaller than the hole in the bolster; and being round at the point and taper, it very materially strains the iron surrounding the hole, particularly in the direction of the line of the row of rivets, and leaves the holes smaller in diameter than the punch with which it has been pierced; and secondly, by the employment of steam riveting machines the edges of the plates are further weakened; and the mischief which has been produced by these two causes has become more difficult of detection, because joints so made are much neater, closer, and more uniform, than where hand riveting is employed.

Now, this subject requires the serious attention of boiler makers, and it will be well for them to resort to other and more accurate and powerful means of judging of the state or condition of work produced in the course of punching and riveting up boiler plates. We have had within the last few days presented to us some specimens of plate-iron joints, which, after being subjected to the most rigid examination by experienced boiler makers, were pronounced as not to be excelled; but upon filing off the outer surface of the over-lapping edge of each plate, a powerful lens at once exhibited the greatly strained and weakened condition of the metal between the rivet holes, and upon applying acid, the better to develop the structure of the iron, the distortion—indeed, the disintegration of the metal at the edges of the plates was made plainly visible without the use of a lens; and as this specimen is a type of the most approved joint-making for boiler purposes, we need scarcely add, that however good originally the whole of the plates might have been, and indeed the body of the plates appeared to be at that time, notwithstanding the appearance presented by the edges, a boiler constructed of such plates with such joints, would have been torn asunder at the rivet holes by a pressure somewhere between 100 and 200 lbs. per square inch, instead of being able to withstand an internal pressure of 480 to 490 lbs. per square inch, which a boiler constructed of plates of the same thickness and quality would have done, if the plates were in other respects unimpared.

With these observations, we proceed to give an authentic verbatim copy of the report prepared by Mr. William Fairbairn, F. R. S., C. E., who had been appointed by the coroner to make an examination of the remains of the boiler:—

Mr. Fairbairn said, the inquiry into the causes of this lamentable accident is surrounded with more than usual difficulty. The apparent contradiction of the facts—on the one side, the lowness of the pressure, the satisfactory condition of the safety-valves, the entire newness and supposed strength of the boiler, and on the other, the terrible destruction of human life—renders this explosion especially remarkable in the

remarkable records of such events. In pursuing my investigation, two separate and distinct subjects forced themselves on my attention:—First, whether there had been any excessive pressure of steam in the boiler sufficient to occasion rupture, had everything been sound; second, whether the material of which the ruptured part of the boiler was composed was defective in its manufacture, or had been accidentally injured in its subsequent working. To one of these two causes—either an over accumulation of force in the interior of the boiler, or a defective plate, must be attributed, in my opinion, the unfortunate casualty under consideration. In regard to the former, there is the evidence of persons who were present from the commencement of the testing until the explosion, to show that the steam was blowing off at both safety-valves during the whole time the engine was standing, and that the balance springs and the Schaeffer's gauge indicated a pressure of 117 lbs. to 118 lbs. on the square inch. I have examined with great care the whole of the valve mountings, and find that the boiler had two safety-valves, $4\frac{3}{8}$ths inch in diameter, screwed down by levers 38 inches long to spring balances, which indicated the pressure per square inch in atmospheres. The distance from the fixed end of the lever to the valve, was 3·54 inches, and from the fulcrum to the end, 34·58 inches, which gives a leverage upon the valve of about 10·7 to 1. The lever and spring balance have been carefully tested, and I find a discrepancy of 9 lbs. per square inch between the actual pressure in the boiler requisite to lift the valve and that indicated by the balance; or, in other words, when the balance was screwed down to seven atmospheres = 105 lbs. per square inch, the actual weight upon the valve was 114 lbs. This excess of strain beyond the indicated pressure is not due to any defect in the spring balance itself, but to the weight of the valve and lever not having been allowed for in the scale graduated upon it. The greatest pressure at which the engine was intended to work was eight atmospheres = 120 lbs. on the square inch: and the balance itself was graduated to indicate that pressure and no more. At the ordinary working pressure of seven atmospheres, there was a range or lift for the end of the long arm of the valve lever of $2\frac{1}{8}$ inches, and this permitted a corresponding lift of $\frac{2}{10}$ths of an inch in the valve itself. This rise opened an annular space equal to $2\frac{1}{4}$ square inches, or a total of $5\frac{1}{2}$ square inches for the two valves, equivalent to a pipe of $2\frac{3}{8}$ inches in diameter.

At this point the question arises whether or no an outlet of $5\frac{1}{2}$ square inches was sufficient to carry off the excess of steam as fast as it was generated in the boiler? To this question I would reply—Judging from the immense velocity with which steam at so high a pressure issues from an aperture, and from a knowledge of the daily and usual working of locomotives whilst standing on railways—that the area of opening was amply sufficient, and it therefore follows (the safety-valves being in every respect efficient and excellent in construction) that the accident did not arise from excessive pressure in the boiler. I am further confirmed in this opinion from the fact that the Schaeffer pressure gauge, which I tested after the accident with water pressure, was found

quite uninjured, and invariably returned to zero after frequent pressures had been applied. We have now to inquire how far the boiler itself was calculated to ensure safety. So far as the proportioning of the parts and the thickness of the plates are concerned, there was no defect; and it can be demonstrated, that supposing the material perfect and the riveting sound, the boiler was adequate to resist a force of at least 500 lbs. per square inch. To show this, I have appended the formula for calculating the strengths, and I may observe that I have also found, as the result of a series of careful experiments, that the ultimate tensile resistance of boiler plates is as given in the following table*:—

	Mean breaking weight in the direction of the fibre in tons per square inch.	Mean breaking weight across the fibre in tons per square inch.
Yorkshire plates, .	24·765	26·763
Derbyshire plates, . .	21·780	18·650
Shropshire plates, .	22·826	22·000
Staffordshire plates, .	19·563	21·010
Mean, . . .	22·519	23·037

The mean strength of boiler plates varies, therefore, from 20 to 25½ tons per square inch. The plates in the exploded boiler being properly proportioned to its size, and the workmanship being everywhere excellent, there remains, in my opinion, but one other alternative to account for the explosion: the presence, somewhere or other—in all probability

* It can be easily shown (see "Useful Information for Engineers," page 39) that if—
d = internal diameter of boiler;
l = length subjected to bursting pressure;
l' = length after deducting part punched out for the rivets;
P = the bursting pressure;
c = the thickness of the plates; and
T = the tenacity of the material;
Then the pressure of the steam to produce longitudinal rupture = d, l, P. The resistance opposed to this strain is evidently the area of material in the longitudinal section multiplied by its tenacity, = 2 c, l', T. Now, at the moment of rupture the bursting pressure is equal to the resistance of the material; that is, $d\ l\ P = 2\ l'\ c\ T$; or,

$$P = \frac{2\ l'\ c.\ T.}{d\ l} \quad . \quad . \quad . \quad (1)$$

Now, in the boiler under consideration, taking the measurements given upon the drawings of the engines; — d = 51 in.; l = 37·7 in.; l' = 20·6 in.; c = 0.5 in.; T = the tenacity of the material we may take at, at least 20 tons, or 45,000 lbs. per square inch. Hence, in this case—

$$P = \frac{2 \times 20\,6 \times 0{\cdot}51 \times 45{,}000}{51 \times 37{\cdot}7} = 480 \text{ lbs.}$$

Or, in other words, 480 lbs. per square inch is the pressure requisite to burst a boiler of these dimensions. But it is to be observed, that the crossing of the joints in a locomotive boiler increases to some extent its power of resistance. If we take for the tenacity of the plate 4·667 tons per square inch, or the lowest result arrived at in the experiments on the exploded plate, we get as above, for the bursting pressure of the boiler—

$$P = \frac{2 \times 20{\cdot}6 \times 0{\cdot}51 \times 10{,}450}{51 \times 37{\cdot}7} = 113 \text{ lbs.}$$

A very remarkable approximation to the alleged pressure in the boiler.

unseen and not discoverable—of weakness in the plate itself. The following experiments upon pieces cut from the exploded plate, appear to strengthen this opinion, and enable us to compare its powers of resistance with the above standard of quality. The experiments were carefully made, and it will be found, that although one of the recorded experiments gives a full average tensile strength, and leads me to infer that the iron of the body of the plate was good, yet the weak powers of resistance exhibited by the other experiments, especially No. 1, indicate the presence here and there of what I may call patches of inferior iron, and show that the plate was not of uniform strength throughout:

Experiment 1.—Breaking weight per square inch of iron drawn asunder, across fibre, 10,456 lbs. = 4·667 tons.

Experiment 2.—Breaking weight per square inch of iron drawn asunder in the direction of the fibre, 45,057 = 20·114 tons.

Experiment 3.—Breaking weight per square inch of iron drawn asunder across fibre, 31,038 lbs. = 13·852 tons.

Now, it is evident from the above, that a plate which yielded to a force of only one-fifth of what it should have sustained, had some of its parts very deficient in strength, and this result is confirmed by the fact that this defect of strength in the plate corresponds precisely with that which would have been anticipated from the bursting pressure of the boiler. The snapping asunder of the plate, in the first experiment, with a weight of 4½ tons to the square inch, was quite unlooked for; the fracture, however, on careful examination, appeared sound, and it must be inferred that this end of the plate contained some original and unseen imperfection, such as I have before alluded to; and that in *that* part of the iron was what is technically called burnt or red short. In explanation of such defects of manufacture, we have only to refer to the acknowledged difficulties which iron makers have to encounter in rolling plates of large dimensions. There is considerable danger of the ends becoming defective, and this happens with the very best makers. It is a mistake, therefore, to suppose that increased strength is invariably obtained by lessening the number of joints in boiler constructions. Such practice is accompanied by the risk of a want of uniformity in the strength of the material. A similar objection applies to very thick plates, which are seldom of the same tenacity as thinner ones, the latter being, in fact, much better adapted for boiler making in general, not only from their superior strength and soundness, but from their superior conducting powers in the transmission of heat.

There is another rather prevalent custom which I consider it my duty to caution the public against, now that they are fully alive to the necessity of obtaining increased security against these explosions. It is a frequent practice to purchase boilers by weight, and amongst the uneducated and unreflecting, the apparently natural, but very illogical deduction is made, that the more they get for their money the better. Now, the contesting after the cheapest rate per ton in purchasing a boiler, is destructive of every sound principle which should be studied in their construction, for the maker, often acting under the influence of a keen competition, is tempted to offer low terms and make up the

deficiency by thicker plates and increased weight; and the result is, that the purchaser often pays more for his boiler of increased weight than he would for one of superior strength of thinner plates. I make these observations for the interest of all, and especially those who erroneously suppose they are consulting economy in such bargains. Reverting to the accident under consideration, it is impossible to state with certainty what part of the joint first gave way to the force of internal pressure; but I am inclined to think that the first rupture occurred in the line of rivets next the smoke box, and close to the corner of the longitudinal joint, as it was at this point of the plate that the weak part was found which yielded to the comparatively small force of 4½ tons to the square inch. Assuming this part to have contained from the first such an element of weakness, it will at once account for the fracture at a comparatively low pressure. Moreover, it is stated that the shock of the explosion forced back the whole mass of the engine, in the direction of its length, upwards of 30 feet; showing that the first rush of steam out of the boiler must have been in the direction of the smoke-box, and that the longitudinal movement of the engine was due to the recoil.

In conclusion, I have to state that I cannot attach blame of any kind either to the manufacturers of the plates or to the makers of the engine. A similar accident might have taken place in my own or any other works. We are subject to such casualties at all times, and although I do not say it would be *impossible* to discover certain elements of weakness in the materials of which the locomotive engine and other constructions are composed, yet with all the ordinary precautions, such as are used at the Atlas Works and all other well conducted establishments, it may happen that a hidden source of mischief may escape detection, and that we may have to deplore such an event as has occasioned this inquiry. WM. FAIRBAIRN.

For the Journal of the Franklin Institute.

The Barometer as an Engineering Instrument.

By JOHN M. RICHARDSON, B. S.

(Continued from page 313.)

Thus far the results given by the level have been regarded as absolutely correct, and those obtained by the barometer as subject to error. But, after the comparisons which have been made, the question very naturally arises, which instrument gives the most reliable results? The question cannot be decidedly answered at present. Theoretically, both the instruments give correct results, but each is subject to numerous errors. The chief sources of error in the case of the level are: (1) construction; (2) adjustment; (3) observation; (4) refraction; (5) dew-point, as affecting refraction; (6) unequal expansion and contraction of the parts of the instrument; (7) curvature of the earth.

The errors arising from (1), (2), and (3), can be reduced to their minimum by careful selection, adjustment, and observation; those arising from (4), (5), (6), cannot perhaps, in practice, be avoided; that pro-

duced by (7) can be partially corrected. The principal causes of error in the use of the barometer are eight, viz: (1) construction; (2) adjustment; (3) observation; (4) dew-point, as affecting pressure of atmosphere; (5) unequal expansion and contraction of parts of instrument; (6) changes of temperature, as affecting pressure of atmosphere; (7) agitation of the upper strata of the atmosphere, currents, &c.; (8) daily variation.

Errors arising from (1), (2), (3), as in the case of the level, can be reduced to their minimum by careful selection, adjustment, and observation; those arising from most of the others can be corrected, but they are usually small; and, regarding the barometer as an engineering instrument, they would not perhaps be corrected, except the one due to changes of temperature.

The adjustment of the level is a complex and tedious operation, and requires so much time that it cannot be done before every observation. Hence an error of adjustment may exist for some time before it is discovered. The adjustment of the mercurial barometer is simple, requires but a moment, and has to be made before each observation. The liability to error of adjustment in the case of the barometer, is not so great, then, as in the case of the level; but an error of adjustment of the former, although small, will probably cause a much greater error in the determination of differences of altitude, than an error of adjustment of the latter.

An error of observation with the level will usually vary the result but little; but, as a very small change in the height of the mercurial column corresponds to a considerable difference of level, a slight error of observation with the barometer may introduce a very material error in the final result. Upon the whole, then, taking into consideration the other errors, as well as those to which allusion has been particularly made, the liability to error on the part of the level appears to be less than on the part of the barometer. Everything, however, will depend upon the care and skill of the observer; care in avoiding errors, and skill in eliminating those which cannot be avoided.

From this view of the relative liability to error on the part of the two instruments, and the examination of observations made with them, it follows, that although the level is probably the most correct, yet the barometer, when carefully used, will be a valuable auxiliary to the engineering profession.

It is to be hoped, however, that more comparative observations will be made with the two instruments; and it is respectfully suggested to scientific gentlemen who may visit Black Mountain, or who may have opportunity to do so at any other mountain, to run carefully a line of levels from the foot to the summit, driving a stake at every station corresponding to a change of level of fifty or one hundred feet, and at every station so determined, to make careful barometric observations. The results thus obtained would probably be of great value, and would determine whether or not *the barometer-differences of altitude are too great within certain limits, and too small within others.* Some of the results of the observations quoted from the report of Lieu-

tenant W., appear to indicate the possibility of this being the case; if it is, and extended observations can alone determine it, the limits between which the barometer-altitudes are too great or too small, can, and should, be determined.

This paper has grown under the hands of the writer into a length much greater than he anticipated, when he commenced it; and the subject will be dismissed, after making some general observations upon the method of conducting a barometric survey, and giving a few formulas, tables, &c.

According to Biot and others, in order to determine the difference of level of two stations by means of the barometer, *simultaneous observations* should be made at them: but this does not appear to be strictly necessary; for, besides the trouble and expense of having two sets of instruments and two observers, if the stations are sufficiently near for the same atmospheric conditions to prevail at them, they will hardly change during the time required for an observer to record his observations at one and pass to the other. If the stations are too far apart for the same atmospheric conditions to prevail at them, it is evidently unnecessary for the observations to be simultaneous.

How far, north and south, east and west, do the same atmospheric conditions prevail? Has observation determined it? It is believed not. Here is a fruitful and valuable field for investigation. If two stations are separated by a considerable distance, and particularly if rivers, swamps, forests, chains of hills, mountains intervene, it appears to be very improbable that the same atmospheric conditions, temperature, amount of moisture, clouds, winds, &c., &c., should prevail at them; and in order to apply the correction for horary variation, it is only necessary to know the time of each observation.

In making a survey, however, it will be best to compare only those observations which have been made under pretty much the same atmospheric conditions. Thus, although it might do to compare together those observations made on a cloudy, or a windy, or a fair and still day, it would not do so well, perhaps, to compare those made on a cloudy day with those on a fair day; or those made on a windy with those on a still day, &c. Hence, having concluded the survey for one day, the survey for the next day should commence at the last station of the previous day's survey. Connecting the different days' work together in this manner, the final result, or difference of level of the two extremities, as determined by this chain of observations, should agree essentially with the result obtained by comparing together the independent observations made at the two extremities. Thus the barometer furnishes a check upon the observations made with it at intermediate stations.

It is advisable that barometrical surveys should be made during fair and calm days only; and as the observations require but little time comparatively, and as they need be taken only where there are considerable changes of level, an engineer can so select his time as to execute the survey in good weather.

Travelers usually employ the "Mountain Barometer" (mercurial)

for the determination of the altitudes of mountains, and for engineering purposes, it is perhaps the best also. But the "Aneroid" is so portable and convenient, and requires such little time for making observations, that, on these accounts, it is preferable to the mercurial. The difference between the two is at most but little, and the "Aneroid" is constantly approaching nearer and nearer to perfection. As bearing upon the relative accuracy of the mercurial and Aneroid barometers, the following mean result of fifty-six comparative and simultaneous observations made upon them by Belville, of the Royal Observatory, Greenwich, England, is given: Mercurial, 29·61; Aneroid, 29·59.

Twenty of the observations agreed exactly. The greatest difference was ·03, and it occurred only three times.

Formulas and Tables.

(1.) From Williams's "Practical Geodesy."

Let h = difference of level of two stations; M and m the barometer-readings at lower and upper stations; T and T′ attached, t and t' detached thermometer at lower and upper stations; then,

$$h = 68{\cdot}965517\left[806 + t + t'\right]\left[\log \mathrm{M} + \log\left(9600 - \mathrm{T} + \mathrm{T}'\right) - \log m - 3{\cdot}982271\right] \quad . \quad . \quad . \quad . \quad (14)$$

Example—

	Thermometers.	
Barometers.	Attached.	Detached.
M = 29·98, . .	T = 63° . .	t = 62 lower station.
m = 26·17, .	T′ = 47 .	t' = 45 upper "

Substituting in (14),

$$\left.\begin{aligned} h &= 68{\cdot}965517\left[806 + 107\right]\left[\log 29{\cdot}98 + \log 9584 - \log 26{\cdot}17 - 3{\cdot}982271\right] \quad . \quad . \quad . \quad . \quad . \\ &= 68{\cdot}965517 \times 913 \times \left[1{\cdot}476832 + 3{\cdot}981547 - 1{\cdot}417804 - 3{\cdot}982271\right] \quad . \quad . \quad . \quad . \quad . \\ &= 68{\cdot}965517 \times 913 \times 0{\cdot}058304 = 3671{\cdot}1415 \quad . \end{aligned}\right\} (15)$$

(2.) From Belville's "Manual of the Mercurial and Aneroid Barometers."

Let h = difference of level of two stations; A the mean height of the barometers in inches; a their difference; b the number in the following table corresponding to the mean height of the thermometers; then,

$$h = \frac{30\,a\,b}{\mathrm{A}} \quad . \quad . \quad . \quad (16)$$

(16) is the formula of Sir George Shuckburgh; it is empirical and gives results rather greater than those of (14); but the experiments of Sir George are regarded as being very exact.

For the Aneroid, Belville gives this formula:

As the sum of the readings: is to their difference: : 55000 : the difference of level.

Let h = difference of level of two stations; M and m the readings of the barometer at them; then,

$$h = 55000\ (\text{M} - m)\ (\text{M} + m)^{-1} \quad . \quad . \quad (17)$$

The results of (17) correspond pretty well with those of (16.)

TABLE *of Sir George Shuckburgh giving the factors corresponding to the mean of the thermometers.*

Therm.	Factor.	Therm	Factor.	Therm.	Factor.	Therm.	Factor	Therm.	Factor	Ther.	Factor.
30°	864·4	39°	883·4	48°	902·3	57°	921·4	66°	940·3	75°	959·3
31	866·5	40	885·4	49	904·5	58	923·5	67	942·4	76	961·4
32	868·5	41	887·5	50	906·6	59	925·6	68	944·5	77	962·5
33	870·6	42	889·6	51	908·7	60	927·7	69	946·7	78	965·6
34	872·7	43	891·7	52	910·8	61	929·8	70	948·8	79	967·7
35	874·9	44	893·8	53	913·0	62	931·9	71	950·9	80	969·9
36	877·0	45	896·0	54	915·1	63	934·0	72	953·0	81	972·0
37	879·2	46	898·1	55	917·2	64	936·1	73	955·1	82	974·1
38	881·3	47	900·2	56	919·3	65	938·2	74	957·2	83	975·2

(3.) From Boye's Pneumatics.

Adopting the same notation as in (14), and representing by L the latitude of the place,

$$h = h' + h'' - h''' + h^{\text{IV}} \quad . \quad . \quad . \quad (18)$$

$$\left.\begin{aligned} h' = &\left[\log\left(\text{M}\left[1 + 0{\cdot}0001001\ (32° - \text{T}) - 0{\cdot}0000104\ (62° - \text{T})\right]\right)\right. \\ &\left. - \log\left(m\left[1 + 0{\cdot}0001001\ (32° - \text{T}') - 0{\cdot}0000104\ (62° - \text{T}')\right]\right)\right] \\ &+ 60158{\cdot}5; \quad . \quad . \quad . \quad . \quad . \\ h'' = &\ 0{\cdot}00111\ (t + t' - 64)\ h'; \quad . \quad . \quad . \quad . \\ h''' = &\ 0{\cdot}0028371\ \text{cos.}\ (180° - 2\,\text{L})\ (h' + h''); \quad . \quad . \\ h^{\text{IV}} = &\ \frac{h' + h'' - h''' + 52252}{20886861}\ (h' + h'' - h'''); \quad . \quad . \end{aligned}\right\} (19)$$

(18) is the most correct formula (theoretically,) of the four which have been given. It takes into consideration nearly all of the errors which can be corrected in the calculation. For extreme theoretical accuracy, M and m should also be corrected for *horary variation.*

In applying (18) care must be taken to give to h'', h''', and h^{IV}, their essential algebraic signs. h'' is usually positive and varies from ·03 to ·06 of h'.

The essential sign of h''' will depend upon the value of L. If L is less than 45°, cos. (180°—2 L) will be negative; and the term—h''', will become $+ h'''$. h^{IV} is always positive.

If the latitudes of the stations differ, L may be taken as their mean.

h''' and h^{IV} are usually so small that they may be omitted when only ordinary accuracy is necessary. Neglecting them, (18) becomes,

$$h = h' + h'' \quad . \quad . \quad . \quad (20)$$

The values of h' and h'' are obtained from equations (19).

The formula by which the results in the "Report" were obtained is not given. This is a grave oversight on the part of Lieutenant W., or his computation. The principal reason for instituting the comparison between the two instruments, was to determine their relative accuracy; and it is not sufficient to give merely the results of the computations; processes and formulas should be given in full. Different investigators have deduced different formulas, and these do not give the same results. In instituting a comparison between the two instruments, the particular formula used in the computations should be given, for any other will not, probably, give the same results.

For engineering purposes the formula should be as simple as possible.

Should this reach the eye of Lieutenant W., it is hoped that he will communicate the formula which he employed.

For more particular information with regard to the philosophy of the barometer, its construction, &c., the reader is referred to Boye's Pneumatics, Belville's Manual, Williams's Geodesy, and works on natural philosophy generally.

The following Tables are given as being not devoid of interest, in connexion with this paper, which treats of the relative accuracy of the level and barometer:

(*a*)

	S. Barom		A. Barom.		Hygrom Lev.		
Hr.	Barom.	Th.	Barom.	Th.	W. B.	D. B.	
7	28·942	61°	28·937	6.°	56°	59½°	4·742
8	28·950	68½	28·962	65	59½	65½	4·736
9	28·964	73	29·000	69½	63	70	4·724
"	"	"	"	"	"	"	4·741
10	28·970	76	29·025	74	66½	74	4·770
"	"	"	"	"	"	"	4·734
11	28·950	78	29·025	77½	70	78	4·736
12	28·952	83	29·025	81	71½	81½	4·725
"	"	"	"	"	"	"	4·732
1	28·930	84	29·012	83½	73	83½	4·722
"	"	"	"	"	"	"	4·734
2	28·912	86	29·006	85	74	86	4·711
"	"	"	"	"	"	"	4·742
3	28·900	85½	29·000	86	74	85	4·684
"	"	"	"	"	"	"	4·740
4	28·900	85½	29·000	86	74½	85	4·715
"	"	"	"	"	"	"	4·740
5	28·900	87½	28·981	85½	75½	84½	4·714
"	"	"	"	"	"	"	4·836
6	28·9000	82	29·006	85	74	82	4·730
"	"	"	"	"	"	"	4·735

(*b*)

	S. Barom.		A. Barom.		Hygrom Lev.		
Hr.	Barom.	Th.	Barom.	Th.	W B	D B.	
3⅔	29·100	82½°	29·250	84°	78°	84°	3·978
5	29·110	82	29·262	84	77½	84	4·041
"	"	"	"	"	"	"	3·982
6	29·118	82	29·262	85	77	83½	4·000
"	"	"	"	"	"	"	3·985
			(*c*)				
7¾	29·142	76	29·312	75½	"	"	4·180
9	29·200	76	29·312	76½	72½	75	4·184
10	29·200	79½	29·330	78	75	78½	4·167
"	"	"	"	"	"	"	4·180
11	29·212	82	29·350	80½	76	81	4·192
"	"	"	"	"	"	"	4·184
12	"	"	"	"	"	"	4·197
"	"	"	"	"	"	"	4·184
			(*d*)				
3	29·134	87	29·305	86	78½	86	4·083
4	29·130	87	29·325	86	77	85½	4·000
"	"	"	"	"	"	"	3·992
5	29·192	85½	29·250	85½	79	86	4·092

The observations in table (*a*) were made on the 30th May, 1857; all of the instruments, except the level and rod, were in doors; the rod was kept in the shade; the telescope of the level ranged about E. and W.

The observations upon the level were made without any anticipation of the results which followed. At 7 A. M., it was carefully leveled and clamped; after which the clamp and tangent screw were not touched until the observations for the day were over. The rod was 66 feet from the level. At 8 o'clock the bubble was observed to be displaced, but the instrument was leveled by means of the leveling

screws, before the reading was taken. Afterwards, two readings of the level were taken at the expiration of every hour; one before leveling, and one after. The numbers at the extremities of the dotted horizontal lines are the readings after leveling. There was a good deal of wind during the day from the south; clouds commenced to gather also, and during the next two days there was much rain.

These facts are mentioned as affecting the barometer-readings; they are not supposed to have influenced those of the level. Curiosity having been excited by the differences of the level-readings, opportunity was taken to verify them by other observations. Those recorded in (*b*) were made during the afternoon of August 7th, 1857. The telescope ranged about N. and S.; the rod was 66 feet south of the level.

On the following morning the observations recorded in (*c*) were made. The telescope ranged N. and S., and the rod was 66 feet south of the level.

During the afternoon of the same day, the observations in (*d*) were made. The telescope ranged E. and W., and the rod was 66 feet on the west.

In the notes giving the observations recorded in (*b*), (*c*), (*d*), nothing is said about the state of the weather, and the presumption is, that it was calm and fair: such also is the recollection of it.

(*e*)

	S. Barom.		A. Barom.		Hygrom.		
Hr.	Barom.	Th.	Barom.	Th.	W. B.	D. B.	Lev.
7	29·310	50°	- -	- -	-	-	- -
8	29·330	58	29·342	56°	-	-	4·988
9	29·344	63½	29·392	62	-	-	5·252
- -	- -	- -	- -	- -	-	-	4·902
10	29·354	66½	29·408	66	-	-	5·000
- -	- -	- -	- -	- -	-	-	4·982
11	29·350	70	29·425	69	-	-	4·983
- -	- -	- -	- -	- -	-	-	4·973
12	29·344	72	29·425	72½	-	-	4·973
- -	- -	- -	- -	- -	-	-	4·980

(*f*)

	S. Barom.		A. Barom.		Hygrom.		
Hr.	Barom.	Th.	Barom.	Th.	W. B.	D. B.	Lev.
1	29·336	74°	29·412	71°	-	-	5·020
2	29·322	75	29·412	75	-	-	5·002
- -	- -	- -	- -	- -	-	-	5·024
3	29·336	76	29·418	77	-	-	4·980
- -	- -	- -	- -	- -	-	-	5·030
4	29·336	82	29·462	84	-	-	4·940
- -	- -	- -	- -	- -	-	-	5·030
5	29·330	72½	29·425	75	-	-	5·030
- -	- -	- -	- -	- -	-	-	5·037
5½	29·328	71	29·412	73	-	-	5·037

Fair, but rather windy.

The observations recorded in (*e*) were made during the morning of 18th September, 1858; those in (*f*) during afternoon of same day.

The variations of the level-readings are attributed to unequal expansion and contraction of the parts of the instrument; but to whatever cause they may be due, it is evident that the bubble will not remain stationary for any great length of time, when the instrument is exposed to the sun.

It very frequently happens that much time elapses, after a back-sight has been taken, before the next fore-sight can be made; during this time the bubble will probably be displaced, and the question arises, should the level-man restore the bubble to the middle of the tube before making the next reading? The observations with regard to this source of error have not been sufficiently multiplied to warrant a decided reply to the question, but the general result thus far, seems to indicate that he should. This subject merits, and it is hoped that it will receive, the attention of engineers. Upon the accuracy of the

spirit-level depends the correctness of their calculations, with regard to many of the most important and costly operations in railroad engineering. The error due to this variation of the reading, whatever may be the cause of the displacement of the bubble, will increase as the distance of the rod from the level is increased. In the foregoing observations the rod was placed 66 feet from the level each time. Calling the error for 66 feet, a; the error for 100 will be, $1{\cdot}5\,a$; for 200, $3\,a$; for 300, $4{\cdot}5\,a$; and so on, in arithmetical progression.

It will be observed from the table, that when the telescope ranged E. and W., the bubble ascended to the west end of the tube in the morning, and the east end in the evening.

Care was taken to place the leveling rod in the same spot at each observation. It was supported upon a broad and hard bearing surface, to prevent it from settling in the ground.

Bowdon, Ga.

AMERICAN PATENTS.

List of American Patents which issued from September 7 to September 28, 1858, (inclusive,) with Exemplifications.

SEPTEMBER 7.

1. Revolving Fire Arm; Ethan Allen, Worcester, Massachusetts.

Claim—Constructing that part of the pin, c, that projects in front of the cylinder, so as to produce a projecting angle toward the junction of the barrel and chamber that is being discharged. Also, the guards, when constructed as described.

2. Harvesters; R. L. Allen, City of New York.

Claim—Elevating the cutting apparatus and balancing the machine in going over stones, stumps, and other obstructions, and traversing hill sides, by means of the long raker and drivers' seat, in combination with lever, F, as set forth. Also, constructing the spring axle of three several pieces, clamped and riveted in the manner set forth. Also, the position of said axle, F, the same being at right angles with the line of draft, and performing the office of spring and axle, and fastened by bolt, x. Also, the form of the socket piece for receiving the ends of the spring standard to support the rakers' and drivers' seat. Also, the construction of the double shoe and standard, adaptable to the cutting of grain or grass, the same being in three pieces, the pieces being put together in a particular way. Also, making the shoe under the mortise thick at edge, a, and thinner at a, in order to give greater thickness and strength to the finger board along a a.

3. Sewing Machines; B. Atwater, Berlin, Connecticut.

Claim—The arrangement of the guide plates with respect to one another, the needle, and the bed plate, viz: so that there may be a space between the bed plate and the upper end or notch of the guide plate, and the two guide plates be placed so close together as to hold the middle of the bow of the loop in position, and bridged across the recess of the plate, substantially in manner for the reception of the needle by the loop, and to effect advantages as set forth.

4. Harrows; David C. Ayres, Lumberland, New York.

Claim—The combination of tubular piece, globular projections, cutters, and teeth, constructed and arranged as described.

5. Corn Planters; A. G. Babcock, Galesburg, Illinois.

Claim—The arrangement and combination of the entire machine.

6. Coal or Ashes Sifters; Louis D. Bartlett, Boston, Massachusetts.

Claim—Using the annular ring and the cover, in combination with the sieve.

7. Joints for Railroad Tracks; E. U. Benedict, Horicon, Wisconsin.

Claim—The combination of the ends of the rail, with the peculiarly constructed wrought iron T-shaped joint plate, by means of the stirrup bolts which pass from the upper surface of the base of the rail through the said base, and through the lips of the plate, and around the lower edge or pan of said plate.

8. Water-Closet; George Blanchard, City of New York.

Claim—The arrangement of the swinging frame, the pedals, the bolt, the seat, the two bars, and the platform, substantially as described.

9. Hanging Bells; George R. Meneely, West Troy, New York.

Claim—Uniting a bell furnished with horns to a yoke, through the intervention of a cap and clevis bolts, as that said bell may be turned in its yoke, in the manner specified.

10. Operating Window Blinds; Theodore Christian, City of New York.

Claim—Coupling the slats together, as described, and connecting a whole panel by means of a rod, in the manner set forth, grooving the rod in a straight line. Also, taking the bearings of the tenons upon the inside of the channel therein, and beyond the pulley.

11. Cane Seat for Chairs; John R. Cannon, New Albany, Indiana.

Claim—The manufacture of chair bottoms, substantially in the manner specified.

12. Grates for Coal Stoves; James Easterly, Albany, New York.

Claim—The combination of the grate, the bar, and the clasp, or its equivalent.

13. Machine for Ruling Paper; J. C. Forman, Cleveland, Ohio.

Claim—The movable bed operated through the medium of the rack and grooved plate, in connexion with the gearing, or its equivalent. Also, the frisket attached to the bar, k, provided with the bar, q, and used in connexion with the bar, J, on the pen beam.

14. Printing and Numbering Press; George J. Hill, Buffalo, New York.

Claim—The combination of a numbering machine and pawl, or its equivalent, with a printing press, as set forth. Also, the adjustable plate, in combination with the numbering machine, as described.

15. Car Seats and Couches; R. E. Fowler, Clayton, New York.

Claim—1st, Having a shaft extended from one end of the seat to the other, when said shaft is furnished at one end with a crank, and at each end with a pinion or friction roller, and said pinion or friction rollers work in connexion with large spur wheels or large friction rollers, which have the arms of the back, d, or the arms of the foot boards pivoted eccentrically to them. 2d, Attaching the arms of the foot board to the lower spur wheel or friction rollers, by means of turning pivots and hinge joints, in combination with attaching the suspension rods of the foot boards by loose eyes to long staples or brackets, substantially as set forth.

16. Machines for Digging Potatoes; Nathaniel Gear, Zanesville, Ohio.

Claim—In combination with the scoop for digging, the skeleton wheel for gathering, carrying, sifting, and delivering the potatoes into the box or receiver, substantially as described.

17. Cutting Device for Harvesters; C. P. Gronberg, Montgomery, Illinois.

Claim—The semi-cylindrical finger bar, A, concave and perforated fingers, B, and the sickle formed of the bar, C, and teeth, D, when the above named parts are constructed substantially as set forth.

18. Fruit Box; Nicholas Hallock, Flushing, New York.

Claim—Constructing a fruit box consisting of two sheets of material, one of which forms the body of the box, the other the bottom, being ventilated as described, and combining therewith the folding handle.

19. Coffee Roasters; Theodore Heerman, Mitchelville, Tennessee.

Claim—The employment of two reversely inclined concentrating plates, which have a space existing between their approximating ends on the inner circumference of a revolving coffee-roasting cylinder.

20. Window Blinds; A. Herder, City of New York.

Claim—The wire cloth strips attached to the window blind, to form a combined blind and insect bar or net.

21. Machines for Moulding Clay; Thomas Hoadley, Cleveland, Ohio.

Claim—The rotating mould and rods or rammers, in connexion with the rammer elevating plate. Also, the guides, one or more attached to the shaft, and used in connexion with the elastic bands on the rammers.

22. Convertible Carriage Shafts; Amos K. Hoffmeier, Lancaster, Pennsylvania.

Claim—1st, The combination of the pole hook with its eyes and points, as they fit into the front ends of the shafts which form the pole. 2d, The arrangement and combination of the shafts operating on joints, that when closed together form the pole.

23. Meat Cutter; Jacob R. Hoyer, Reading, Pennsylvania.

Claim—The arrangement of the knives in pairs on the periphery of the revolving cylinder, with their edges radiating from the centre of the cylinder, so as to operate the same as shears in passing between the knives of the hollow cylinder.

24. Ploughs; Samuel Hulbert, Ogdensburgh, New York.

Claim—The adjustable beam, slot, pivot, spring clevis, and adjustable handle, combined as set forth.

25. Kneading Machine; Wm. S. Reinert, Philadelphia, Pennsylvania.

Claim—The shaft with its corrugated roller and pinions, in combination with the guides and pinions, when the whole of the above named parts are so constructed and arranged in respect to the trough, that they may have an upward or downward movement controlled by the weight, or its equivalent, independently of the trough.

26. Apparatus for Applying Soles to Boots and Shoes; Jacob Jenkins, Charlestown, Massachusetts.

Claim—The combination of the elastic bed and the sole adjusting cavity or space arranged in a press, and so as to operate together as specified. Also, constructing such sole adjusting cavity with adjustable sides or adjustable ends, or both its sides and ends made adjustable. Also, the combination of the lever clamps with the adjusting cavity and the elastic bed, and so as to operate therewith. Also, the combination and arrangement of the tank with the elastic bed and the sole adjusting cavity.

27. Escapement of Time-keepers; Joseph Jennet, Meadville, Pennsylvania.

Claim—The first balance wheel constructed with cogs on its periphery, gearing into the pinion, and the second balance wheel moved thereby, in the manner described.

28. Iron Safe; Lewis Lillie, Troy, New York.

Claim—The mode of forming the corners of a safe with anchors, also the jamb, as set forth.

29. Railroad Indicator; Gardner R. Lillibridge, Wayne Co., Michigan.

Claim—The trap or obscurer, in combination with my peculiar method of exhibiting the number of miles between stations. Also, a movable cradle which contains and confines the cylinder's scroll and friction rollers, in combination with the screw for regulating the tension of the scroll.

30. Cultivators; Israel Long, Terre Haute, Indiana.

Claim—The employment of two frames which are furnished with harrowed teeth at their forward end,

and cultivator teeth at their rear ends, and connected by arch braces, in combination with the propelling wheels arranged on short crank axles, the tongue, arranged on top of the arch braces, and with the adjusting arrangements.

31. MACHINE FOR PRINTING ADDRESSES ON NEWSPAPERS, &c.; James Lord, Pawtucket, Massachusetts.

Claim—1st, Imprinting the names and addresses of subscribers and others, on newspapers, envelopes, &c., by inserting type expressing such name and address in boxes secured spirally on the periphery of a revolving cylinder, and causing the said newspapers or envelopes to be successively pressed against the type in the boxes by means of a platen or follower which is made to act in concert with the cylinder. 2d, The combination and arrangement of the connecting rod, vibrating lever, pawl, ratchet, and screw shaft, for giving the required revolving motion to the printing cylinder, and longitudinal motion to the platen, and receiving, conducting, and distributing rollers. 3d, The combination and arrangement of the eccentric cams, longitudinal shaft, and upright rod for raising the platen or follower to produce the required impression upon the paper. 4th, The combination and arrangement of the cima reversa formed slots in the ears and ends of the branch rods of the curved bars, with the distributing and conducting ink rollers. 5th, The combination of the adjustable plate, oscillating bar and plate, between which it is secured, and graduating thumb screws, with the ink receiving roller.

32. APPARATUS FOR PREPARING ELLIPTICAL FRAMES FOR GILDING; Robert J. Marcher, City of New York.

Claim—Providing the bar with a foot or support and sliding plate or tool, when the bar is arranged relatively with its upright grooved or slotted bar, and the frame.

33. HOISTING AND DUMPING APPARATUS; George Martz, Pottsville, Pennsylvania.

Claim—The combination of the car, hung and controlled in its up and down movements in the peculiar manner specified, with a sliding gate and stationary frame, which are constructed and arranged in the peculiar manner specified.

[This invention consists in a car closed in at top and back, pivoted to a sliding gate, and governed in such a manner that its tail-board lies horizontal while the car is being loaded, and its bottom horizontal while the car is being dumped, said car and sliding frame being arranged within a stationary frame, which is furnished with suitable guides for governing its movements and allowing the car to dump, and with a suitable shute, which compels it to tilt and dump a load, and which also holds it in such a condition that while being lowered its bottom is compelled to stand vertical, and its back lie horizontal when down, and being loaded.]

34. BUTTER WORKER; Ziba Williams, Ithaca, New York.

Claim—The combination of a trough and a ladle having parallelism to the axes thereof, for the purpose of working butter, when the same are constructed and arranged in the manner described.

35. PADDLE WHEEL PROPELLERS; John May, Columbus, Georgia.

Claim—The arrangement of the buckets or floats with the guides, with the centre and the frame, arranged in the manner described.

36. GOVERNOR VALVE FOR STEAM ENGINES; Stuart B. McCray, Grand Rapids, Michigan.

Claim—1st, Having a hollow cylindrical valve constructed and arranged to work in suspension over a vertical piston, so that it does not come in contact with any horizontal surface, nor has any point of binding contact against said vertical piston. 2d, The suspending and working of a hollow cylindrical valve, by means of an eccentric or other analogous device, which said eccentric is so arranged on the shaft of the slotted rocking link that its longest radius is at right angles, or nearly so, with the valve stem, when the valve is closed, and its shortest radius parallel, or nearly so, with the link of the governor.

37. BINDING ATTACHMENT TO REAPING MACHINES; James Mitchell, Osceola, Iowa.

Claim—1st, The combination of the jaws, arranged as shown, and attached respectively to the slider and springs, whereby they are made to receive and grasp the ends of the band. 2d, The clamp constructed of two parts attached to the rotating wheel, and used in connexion with the slide bar and ledge, for the purpose of twisting the ends of the band. 3d, The jaws, clamp, band twisting device, tucking rod, and discharge rod, combined and arranged to operate as set forth.

38. COUCHES FOR RAILROAD CARS; F. R. Myers and F. H. Furniss, Cleveland, Ohio.

Claim—The couch with the rods and the collars or the adjustable collars and springs, as an arrangement of means for providing such number of couches as, in connexion with such as may be made of the car seats, will accommodate a complement of passengers.

39. CALIPERS AND DIVIDERS; Joseph D. Moon, Chelsea, Massachusetts.

Claim—Having the parts of the legs made of circular form, geared or toothed, and the screw placed between them and gearing therein, the above parts being fitted within the socket, and the screw provided with nuts.

40. RAKING ATTACHMENT TO HARVESTERS; John Nelson, Rockford, Illinois.

Claim—The arrangement of the arm and rake connected by an articulating joint, the spring and cord, in combination with the guide.

41. SCYTHE BLADES; Samuel D. Nelson, Pittsburgh, Pennsylvania.

Claim—Constructing grass and cradle scythes by starting the web of the scythe from one edge of the back, making the back concave on the upper and convexed on the lower side, leaving the heaviest and thickest part of back on the centre, and to the outside of the convexed side of the back, thereby making the scythe stiffer and stronger.

42. HARROWS; Samuel J. Orange and George Bridelman, Grayville, Illinois.

Claim—The combination of the handles, or their equivalent, with the transverse beams and rollers, and the circular frame, by which we are enabled, by regulating the pressure on the handles, to guide the harrow in the line of the draft or deflect it at pleasure.

43. SEED PLANTERS; Benjamin Owen, Dayton, Ohio.

Claim—Operating the arms and hoe by means of the disks provided with teeth or spurs, and arranged as set forth.

44. OPERATING VALVE OF STEAM ENGINES; H. Uhey and H. A. Luttgens, Paterson, New Jersey.

Claim—The cam, or equivalent, in combination with the valve gear, adapted to operate a single slide valve.

45. PORTABLE COPYING APPARATUS; Wm. Van Anden, Poughkeepsie, New York.

Claim—The improved method of uniting a cylindrical removable back or holder with a copying back, by means of a concave or tubular channel cut longitudinally with the face of the cylindrical back or holder.

46. Machine for Turning Hubs; Alexander Rickart, Schoharie, New York.

Claim—Rotating the mandrel of the carriage from the cutter shaft through the medium of the worm wheel and screw gearing, as described—it being understood that I do not claim, broadly and in the abstract, the well known mechanical device of a worm wheel and screw gearing—but the parts above named, when arranged with the cutter shaft and mandrel of the carriage, so that the mandrel will be connected with the shaft, and disconnected therefrom at the proper time, by the movement of the carriage.

47. Billiard Balls; Calvin B., John, and Wm. C. Rogers, Deep River, Connecticut.

We do not claim simply the cementing of a series of pieces of ivory together, and turning the same to form a billiard ball, irrespective of the disposition and arrangement of said pieces in respect to each other, as described, for various articles are formed in sections or of a series of pieces joined together, and turned or otherwise formed into proper shape.

Claim—Constructing billiard balls of a series of pieces, three or more cemented, or otherwise secured together, when said pieces are disposed or arranged in relation to each other in respect to their fibre or grain.

48. Coal Stoves; Silas T. Savage, Albany, New York.

Claim—The combination of the magazine, radiators, and the air chamber at the base of the radiators, as arranged in reference to and with each other, substantially as set forth.

49. Coal Stoves; Silas T. Savage, Albany, New York.

Claim—The combination of an open cylindrical or basket grate, with a dome or a cone shaped cover placed within an outer chamber, having a register for the admission and regulation of a current of air between the grate and the walls of said chamber, arranged near the bottom of the chambers, substantially as the same is described.

50. Construction of Coal Stove Lining; Silas T. Savage, Albany, New York.

Claim—The employment of metallic framing to contain fire-clay or other lining for coal stoves, for the purpose of preserving it from injury by adhesion of clinkers.

51. Looms; E. M. Scott, Auburn, New York.

Claim—1st, Operating the shuttle motion by means of the lay, in the manner described. 2d. The combination of the sliding shaft attached to the lay, the rollers, or their equivalents, on said shaft, the cam and its appendages attached to the lay for giving longitudinal motion to the shaft, and the dog attached to the breast beam to operate the cam, the whole applied and operating substantially as described, to actuate the shuttle motion at one side of the loom only at a time by the movement of the lay. 3d. Operating the harness motion by means of the lay, in the manner specified. 4th, The combination of the swinging frame and its dogs, cams, and turning plate, with the lifting rods below the headle frames, the dog and the lay, to cause the headles to be operated alternately or in proper order of succession.

52. Hose Carriage; I. S. Schuyler and L. A. Rockwell, City of New York.

Claim—1st, The arrangement and combination of two separate and independent rope reels, respectively and separately with the bearing wheels rotating on the axletree to which the reels are secured. 2d, The described method of connecting and disconnecting the rope reels, with the bearing wheels of a fire engine, hose cart, or other fire apparatus, for the purpose of taking in the drag rope while the apparatus is drawn by it.

53. Machine for Ironing Clothes; John Shaefer, Lancaster, Pennsylvania.

Claim—The combination and arrangement of the hollow cylinder, with the rollers, the screws and caps, the spigot, the screw plug, the screw, the tables, all secured in the frame, and operated by the crank and gear wheels.

54. Carpet Sweeper; Reuben Shaler, Madison, Connecticut.

Claim—1st, The combination in a machine for sweeping carpets, of a brush, the bristles of which are set at an angle of about forty-five degrees from a radial line passing directly outward from the axis constructed with a traction roller. 2d, The construction of a traction roller of a sweeping machine, by winding a spiral flanch of india rubber, or other flexible and adhesive substance, around a cylinder, by which a very powerful adhesive traction of said roller is insured, and the roller is much more cheaply manufactured.

55. Seeding Machines; Samuel Stanbro, Salem, Michigan.

Claim—The application of a twisted cord, in combination with measuring tubes, arranged for the purpose of measuring and delivering seed.

56. Method of Manufacturing Shingles from the Log; C. L. Story, Owensboro', Kentucky.

Claim—The circular saw, rotary and laterally moving cutters, the rotary cutters, and traveling carriage, arranged and combined, whereby the shingles are cut from the bolt, tapered and jointed at one operation. Also, the particular means for rotating the bolt at each termination of the movement of carriage, and thereby setting the bolt to the saw, to wit: the screw worm wheel, actuated through the medium of the arm, rod, bar, rod, and guide ledge.

57. Trap for Animals; R. M. Turner, Woodland, Michigan.

Claim—The tilting platform and treadle connected with the spring catch, the platform being placed within the base, and the platform and treadle arranged in relation with the box and bait chamber.

58. Alarm Locks; J. W. Wells, Pittsburgh, Pennsylvania.

Claim—The use and combination of a bell catch in the keeper of a lock, and a spring catch in the locking bolt, so arranged as to set the alarm by simply locking the door, and to spring the alarm and ring a bell whenever the door is unlocked.

59. Brick Machines; Henry White, Cleveland, Ohio.

Claim—1st, The beveled joints of the mould, as arranged. 2d, The mechanism, when relatively arranged in its several parts as set forth.

60. Method of Allowing for Expansion and Contraction of Fences; Olly Williams, St. Louis, Missouri.

Claim—The combination of the shaft with the post, and the application of the wires to the said shaft, whereby all the wires are tightened at one and the same time by one and the same weight.

61. Sewing Machines; J. B. Woodruff, Washington City, D. C.

Claim—1st, The double corrugated yielding spring between which the thread is guided, the same being regulated by a thumb-screw, or any equivalent device, to bear upon the thread in the manner described, to produce any degree of tension required. 2d, Making the bowl or shuttle carrier, and attaching it to the slotted driver, in combination with the circular shuttle race. 3d, The application of extension rods for pitmans

to sewing machines, when used in combination with a hinged foot-piece to be placed upon the floor, and the machine upon a table.

62. LIFE-BOAT CONSTRUCTED OF MATTRESSES; Jabez M. Woodward, City of New York.

Claim—1st, Constructing the mattresses with the strong canvass or duck attached to them with the eyelet holes, so that they can be united at their edges by lashing for the purpose of making a boat or life raft. 2d, The manner of constructing the berth bottoms or supports into frames in the shape of, or similar to, right angled triangles, in combination with the mattresses. 3d, The combination of the mattresses, canvass, and eyelets, with the lashings, diaphragm frames, and spar, arranged into the form of a boat or life raft.

63. STAMPING MILK CANS; Wm. Mt. Storm, Assignor to Allan Cummings, City of New York.

Claim—The press with the counterpart die-bearers, forming segments of two concentric circles to fit the exterior and interior of the "breast" of a narrow mouthed can, and having the movable S-shaped head block carrying the follower by guide rods, as shown, on the one part of a die-bearer, while the counterpart die-bearer is provided with rods with hands that pass through holes provided in the can to catch upon the head block, the whole being so constructed that two parts of the press may be combined and operated through the thickness of the can to perform its office, and thereafter be readily separated and removed, the purpose being to facilitate the marking of such cans after construction is completed.

64. SEWING MACHINES; M. L. Clinton, Assignor to H. F. Hibbard, Ithaca, New York.

Claim—The cams on shaft, in combination with spring hook, constructed and operated in the manner described.

65. BULLET MACHINE; C. Young, Auburn, New York.

Claim—1st, The application of elastic rolls, for the purpose of feeding lead wire into the machine. 2d, The application of the arrangement or device for gauging, cutting, and depositing the lead into the dies by the same instrument, and the manner of constructing and operating this portion of the machine. 3d, The application of the arrangement or device of lateral punches for removing the bullet from the dies.

66. MANUFACTURE OF BRUSHES; Stephen Barnes, Assignor to self, Henry S. Parsons, and Samuel Rowland, New Haven, Connecticut.

Claim—The securing of the bristles in separate tufts, in the manner described, by the employment of the tubular block, or its equivalent.

67. SEWING MACHINES; S. C. Blodgett, Assignor to G. B. Sloat & Co., Philadelphia, Pennsylvania.

Claim—My improved mode of operating the hook about the bobbin, viz: with a compound motion produced by a crank and an arm or by two cranks, whereby the point of the hook is made to travel either in an elliptical or circular path, without being reversed or made to point upward and downward during its rotation. Also, the particular mode of constructing the hook, viz: so that not only the heel part thereof shall lap over the edge of the bobbin, but the point of the said hook extend obliquely, in manner as described, or toward the needle, and so as to operate therewith as explained, and making the said hook with an auxiliary hook or notch, the same being to operate together as specified.

68. FLUES OF ELEVATED OVEN COOKING STOVES; James Easterly, Assignor to self and D. G. Littlefield, Albany, New York.

Claim—Combining with flues, p p, and a centre passage, arranged substantially as described within the stove, an elevated oven having its flue space, on its sides and top an open chamber, in connexion with a descending flue with its exit at the base.

69. STEAM PRESSURE AND WATER INDICATOR; William C. Grimes, Assignor to David Matthew, Philadelphia, Pennsylvania.

Claim—Constructing and arranging the concentric glass tubes with the connecting pipes. Also, the manner of constructing and arranging the connecting pipes with the boiler and the branch or equilibrium pipe between the concentric connecting pipes at the water line of the boiler.

70. COUCH SEATS FOR RAILROAD CARS; John Hartman, Jr., Assignor to John Hartman, Sr., Philadelphia, Pa.

Claim—The combination and arrangement of devices whereby the seat proper can, at the pleasure of the operator, be arranged and securely maintained either in the horizontal position of a chair seat, or in the same plane with the inclined position of the foot-rest frame as a couch, the same consisting of a pedestal, seat, stem, brace, and foot-rest frame, or their equivalents, combined so as to operate substantially in the manner described.

71. DIAPHRAGM FOR PHOTOGRAPHIC CAMERAS; C. C. Harrison and J. Schnitzer, Assignors to C. C. Harrison, City of New York.

Claim—The adjustable diaphragm or stop, composed of overlapping plates operated concentrically by the ring, or its equivalent, said ring being operated from the outside of the tube by means of the lever or arm, or other appropriate device, as described.

72. RAILROAD CHAIRS; Adam Hay, Assignor to self, S. W. and L. B. Miller, Newark, New Jersey.

Claim—1st, The lip or projection, formed as represented, to support the flanch of the rail, and in turn to be supported by the upper portion of the wedge. 2d, A chair having an aperture for the wedge which will in itself contain and secure the wedge, and yet leave it free to support the flanch perpendicularly, and to bind the rail laterally. 3d, The combination of the lip with the flanch of the rail and the wedge, in other words, I claim the support of the flanch by the lip, and the supports of the lip by the wedge, affording a firm rest for the flanch, at the same time preventing by this combination of wood and iron all vibration and jar. 4th, The combination on the chair of the wooden plug and the screw, in the manner described.

73. STEAM TRAP; J. W. Hoard, Assignor to self and G. B. Wiggin, Providence, Rhode Island.

Claim—The combination with the outer case or chamber of the valve, lever, diaphragm, mercury holder, and openings, constructed and operating as described.

74. JOURNAL BOXES; H. H. Thayer, Sandwich, Assignor to J. A. Woodbury and S. A. Woods, Boston, Mass.

Claim—The combination of two, or any other suitable number of lubricating chambers and bearing surfaces, with one trough or channel arranged below them, as specified. Also, the combination of the intercepting chamber at each end of the box, with the oil trough, the lubricator chambers, and the bearing surfaces. Also, making the opening of the chamber of greater diameter than the journal, in manner specified. Also, in combination with the intercepting chamber, the intercepting groove, arranged in the cap in the manner specified.

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75. WASHING MACHINES; John Allen, Galena, Maryland.

Claim—So dressing with zigzag ribs the bottom of the tub and under surface of the rubbing disk, that the approximating angles of the ribs of the disk and tub shall form rhomboidal figures, wherein the clothes are subjected to an angular squeezing and oblique rubbing action, and the approximating knuckle or wedge shaped ends of said angles shall, when the motion of the disk is reversed, after the rhomboidal spaces and pummel and loosen up the clothes, so as to allow a fresh supply of cleansing water to circulate through them, and thus prepare them for a succeeding angular squeezing and oblique rubbing action.

76. WASHING MACHINE; Wm. T. Armstrong, Sandwich, Illinois.

Claim—The combination of the rubber and the slide with the stationary shaft.

77. REVOLVING FIRE ARM; Fordyce Beals, New Haven, Connecticut.

Claim—Constructing, applying, and arranging the centre pin and the rammer lever, so that the former is locked in place by the latter, when the latter is close to the barrel, and that the former is permitted to be withdrawn by bringing the latter to a position in which the rammer will not interfere with the cylinder.

78 LADIES' HOOP SKIRTS; Samuel Beberdy, Philadelphia, Pennsylvania.

Claim—The combination of a spiral stay with the fabric which constitutes a lady's skirt, when said stay is formed by winding a flexible strip or rod made of one piece or a series of pieces spliced or united together, continuously round the skirt from the bottom to the top of the body of the same.

79. JOINTS FOR T-RAILS; E. U. Benedict, Horicon, Wisconsin.

Claim—The combination of the rails with the side plates by means of the slots in the plates, the recesses in the bases of the rails, the gibs, and the keys. Also, forming the gib applied at the juncture of the rail, with the downward rectangular projection to serve as a stay between the plates.

80. MANUFACTURE OF SKIRTING MATERIAL; Ernest Bredt, City of New York.

Claim—The looped fabric described, having loops formed in it at intervals by combining the loop-forming material with the web in the process of weaving.

81. ENDLESS SECTIONAL SAWING MACHINE; Harvey Brown, City of New York.

Claim—1st, The form and manner of constructing the section of my saw. 2d, The mode of inserting the teeth in the saw, in the manner set forth. 3d, The guide plate, constructed and arranged as described, when used in connexion with the saw.

82. SAW FILER; A. H. Burdine, Chulahoma, Mississippi.

Claim—1st, A file constructed spirally on a revolving axis, so that a space exists between the two ends of the spiral or screw thread constituting the file. 2d, The combination of one or two of the above specified files with two conical rotating files, in a machine of the character specified.

83. PRINTING PRESSES; J. A. Campbell, New Orleans, Louisiana.

Claim—The teeth placed on a portion of the perimeter of the roller, for the purpose of pushing the card through the opening above the perpendicular grooves by the operation of these teeth on the surface presented by the front card of the pack, in combination with the rollers. Also, the adjustable plates, as specified, for the purpose of regulating the opening through which the cards have to pass to the thickness of the card. Also, the combination of the stationary arm, ball and socket, rod, short arm, and the working joint, for the purpose of giving the inking cylinder a lateral motion.

84. LANTERN ATTACHMENT TO CAPS; J. C. Cary, City of New York.

Claim—The lantern, constructed as shown, to wit: the fountain and lamp connected by the tube, and enclosed within the case, which is provided with the handle, bail, and straps, for the purpose of being attached to the cap.

85. RAILROAD CAR COUPLING; J. W. Corey, Crawfordsville, Indiana.

Claim—The arrangement and combination of the hinged coupling hook, slotted connecting link, and double inclined plane.

86. MOULDS FOR MAKING WARP DRESSER GUIDES OF GLASS OR OTHER PLASTIC ANTI-CORROSIVE MATERIAL; Alfred B. Corey, Franklin, Connecticut.

Claim—My improved mould as made with plunger cavities of the kind described in its bed plate, a body or body and flanch matrix, a removable plunger guide, or its equivalent, and a plunger provided with a series of projections or cores.

87. WARP DRESSING GUIDES; A. B. Corey, Franklin Connecticut.

Claim—A new or improved manufacture of warp dresser guides made of glass, or its equivalent, and by moulding it on smooth cores, and subsequently reducing the plate or the bars or projections made by the cores. Also, making a warp dresser guide in several separate sections, combined and applied in one frame.

88. STEAM HAMMER; Patrick Danvers, City of New York.

Claim—The combination with the reciprocating cylinder or ram, which constitutes or has attached to it the hammer block and the stationary piston, 5, of the piston, 4, and the external steam cylinder, provided with a proper system of valves.

89. SHINGLE MACHINE; Augustus Day, Detroit, Michigan.

Claim—1st, The butting or squaring knife, operated by the curved arms, and used in connexion with the stationary knife and adjusting clamps. 2d, The combination of the riving knife, jointing cutters, planers, and butting or squaring knives.

90. MOULD PLOUGH; Adam Defenbaugh, Walnut Run, Ohio.

Claim—So hanging the beam, wheels, and underground plough to each other as that the conductor of the machine may, at any time, without seeing the plough, raise and lower it so that the ditch shall have a regular descent regardless of the undulations of the ground underneath which it is formed, and over which the plough passes. Also, in combination with the underground plough, the scoring wheel, for forming a secondary trench in the bottom of the ditch, for the purpose set forth, and the friction rollers for relieving it.

91. TELEGRAPH INSULATORS; M. G. Farmer, Salem, and J. M. Batchelder, Cambridge, Massachusetts.

Claim—The iron wire supporter or hook, in combination with a screw insulator made of hard india rubber, and attached to the hook or shank.

92. Combination of a Governor with a Slide Valve; Richard Gornall, Baltimore, Maryland.

I do not limit myself to any particular character of taper steam ports, as various forms of taper ports might be made to answer the end in view, nor do I limit the use of my invention to flat surfaced slide valves, as it can be applied in connexion with a cylinder valve or a valve forming part of a circle with equal advantage.

Claim—1st, The combination in the manner specified, of the governor with a slide valve, which is constructed and operating as specified. 2d, Giving the crank pin by which the rock shaft is operated, a flaring or V-shape, in combination with the oblique or bevel ends of the slide valve and the enlarged slot of the connecting rod.

93. Rotary Steam Engine; John and Ezra Harthan, Timbersbrook, England; patented in England, January 26, 1858.

Claim—1st, The system or mode of obtaining motive power by causing steam or air to impinge upon a series of chambers with curved bottoms arranged around a wheel at or near the periphery thereof. 2d, The general construction and arrangements of machinery or apparatus for obtaining motive power.

94. Machine for Cutting Dovetails; T. E., A., and E. King, Cherry Valley, Ohio.

Claim—The parts shown in figs. 4, 5, 7, and 8, arranged and operating as described, for the purpose of cutting the mortises or gains in the drawer fronts. Also, the instruments shown in figs. 9 and 10, arranged and operating as specified, for the purpose of cutting the end pieces of drawers.

95. Horse Powers; G. Hely, Rochester, Wisconsin.

Claim—The combination of the sliding levers and the loose coupling bar with the draft chains.

96. Gate Hinge; T. Hendrick, Clyde, New York.

Claim—The employment of an angle plate having an oblong slot cut vertically through its horizontal angle, in combination with a plate which has the pintle or axial pin of the hinge on its lower edge, and a shifting projection on each of its side edges.

97. Gas Burners; L. E. Hicks, City of New York.

Claim—The construction of gas burners which have caps made with a crown concave internally applied to them, making the outer surface of the crown of the cap flat, or nearly flat, and the orifice through which the gas escapes of circular form horizontally and with its edge curved in the path of two vertical circles.

98. Building Walls under Water; Wm. H. Horstmann, City of New York.

Claim—1st, The sack or compartment formed by cloth, or some equivalent thereof, to produce slack water in a current or other movable water, and protect the current from being washed away and wasted before it is hardened. 2d, In combination with a flexible inclosure, the panels, as above specified, and supporting the same by spiles, in the manner set forth. 3d, The cement feeder, constructed and arranged substantially as specified.

99. Cutting Apparatus for Harvesters; Charles Howell, Cleveland, Ohio.

Claim—1st, A finger formed with a frog-shaped concavity on the under side of the knife, having outlets on its sides in front of the finger bar, in the manner set forth. 2d, A sickle or knife having a series of curved openings, or their equivalents, formed on its rear and under side, when used in connexion with guard fingers provided with a D-shaped rest, or its equivalent.

100. Heating Apparatus for the Manufacture of Cemented Sole Shoes; Jacob Jenkins, Charlestown, Massachusetts.

Claim—An improved heating apparatus for the manufacture of cemented sole shoes, consisting of the box provided with door, glass front, deflector, as described, openings, and lamp, or its equivalent, for heating.

101. Churn; Daniel Johnson, City of New York.

Claim—The employment of two or more rollers when placed horizontal and with their peripheries touching or nearly touching one another, in combination with a revolving dasher, which is arranged underneath said rollers, and in the same box or chamber with the same.

102. Railroad Car Couplings; C. P. Kenyon, Wilson, North Carolina.

Claim—The combination of the grooves, supporting ridges, lateral grooves, pusher, and blocks, arranged as described. Also, adjusting the coupling to suit cars with platforms of different heights, by means of the slide and a bolt passing through the holes, arranged as described.

103. Door Lock; Jacob Kinzer, Pittsburgh, Pennsylvania.

Claim—The use of a plate on the inside of a lock, which, by the insertion of the key, is moved to the other side of the lock and closes the opposite key-hole. Also, the use of said plate upon which to raise or form circles or segments, wards or pins, or their equivalents, which correspond to the formation or changes of the key, thereby facilitating and cheapening the manufacture of the lock.

104. Bullet Machine; J. A. Knight, St. Louis, Missouri.

Claim—1st, Arranging the movable mould bars, so that in opening the moulds they move not only away from the stationary mould bar, but to some extent in a direction transverse to the said stationary bars, as set forth, to produce the dragging action described, for the purpose of loosening the bullets from both parts of the moulds. 2d, Arranging the said swinging mould bars between centre screws, applied in such a manner as to provide for their adjustment longitudinally to obtain a perfect registration of the two halves of the several moulds.

105. Machines for Working Clay; Henry Leguay, St. Louis, Missouri.

Claim—My invention in mills or grinding gears for grinding clay or other substances, making openings and valves, substantially as described, in the spaces between the teeth in one or both gears to receive and hold the clay or substance ground. Also, in combination with the grinding gears, the moulding tube, when these parts are constructed and arranged for joint operation.

106. Machine for Notching and Trimming Hoops; Sanford Littlefield, West Troy, New York.

Claim—The relative arrangement of the cutters moving in ways rectilinearly and obliquely, whereby the notch is cut and trimmed in one operation.

107. Cutting and Finishing the Locks of Wooden Hoops; Hiram Littlejohn, Troy, New York.

Claim—The two separate knives, A B, when arranged together with a suitable bed, C, for use in cutting the locks of wooden hoops. Also, the knife, D, when arranged in combination with the knives, A B, or their

substitute, and the bed, C, for "barking" the lock while the hoop remains in the same place on the bed that it occupies during the cutting of the lock. Also, the knife, E, when arranged in combination with the knives, A B, or their substitute, and the bed, C, for trimming the lock while the hoop is in the same place that it occupied during the cutting of the lock.

108. COATING ELECTROTYPE MOULDS; Henry Lovejoy and Robert Wheeler, Brooklyn, New York.

Claim—1st, Suspending the brush bar by the crank at one end, and attaching it to, and operating it by, the crank of the crank shaft, at the other end. 2d, The combination of the brush and bed with the blower and wind chest.

109. VALVE COCK; J. C. Macdonald, Cincinnati, Ohio.

Claim—The collar on the valve stem, the guide cap, spring, head, connected with the stem by the handle and screw cap, combined as set forth.

110. BEDSTEAD FASTENING; I. M. May, Anderson, Indiana.

Claim—The combination of the plates secured respectively to the post and rails, and provided with the oblique slots and pins.

111. TENONING MACHINE; John McCreary, Delaware, Ohio.

Claim—The construction and arrangement of the bit-holders, as set forth. Also, the manner of applying the set screw, as described.

112. HEMP BREAKS; H. D. McGeorge, Morgantown, Virginia.

Claim—Breaking and cleaning hemp, flax, &c., by a combination of vibrating blades and stationary blades, and clearing devices acting in concert with them.

113. MEAT CUTTER; M. Newman, Oak Hill, New York.

Claim—In combination with the cutters the two branched rack or comb for holding the material against the cutter. Also, holding the rack or comb in its recess by the clamping of the two parts of the shell together. Also, the manner of holding and arranging the screw feeder on the shaft, so that a portion of the section of the screw shall be on said shaft.

114. TEMPLES FOR LOOMS; R. Pilson, Laurel, Maryland.

Claim—The construction of temples for looms, wherein is employed an adjustable extension compound connecting bar or rod composed of the spindle bars or sections, and the splice lengths, the detachable independent tubular sheaths, the sliding yielding brackets or bearings, spring holders and springs, and whereby a double yielding action of the temples is brought about.

115. HARVESTERS; Isaac Reamer and Henry Miller, Conrad's Store, Virginia.

Claim—1st, Arranging the knife on springs and with its cutting edge slightly elevated above its rear edges. 2d, The employment of an auxiliary adjustable reel, in combination with the main reel.

116. CLASPS FOR COTTON BALE HOOPS; A. C. Richard, Newtown, Connecticut.

Claim—The use of the three rings, in combination with the hoop, as a cheap and convenient cotton bale hoop.

117. COOKING STOVES; Apollos Richmond, Brooklyn, Connecticut.

Claim—Extending the oven forward in a curved form and arranging around it the boiler holes, as set forth, in combination with the curved fire chamber.

118. BED BOTTOM; F. Russell, Otselic, New York.

Claim—The combination and arrangement of the rods with the wires, 5, the bolts in the rails, substantially as specified.

119. SPRING BALANCES IN COMBINATION WITH A KNIFE; George H. Smith, Glenwood, Iowa.

Claim—A knife having a spring balance inserted in its handle, as set forth.

120. LANTERNS; Stillman C. Spaulding, Rutland, Vermont.

Claim—1st, Constructing a lantern by folding the edges of the several parts over wire frames, so that it can be compressed and packed in a small space on removing the glass sides, and in the way set forth, and so that solder is not needed to secure the pieces composing the top and bottom. 2d, The use of a coiled wire in the manner mentioned, to retain the glass sides in their place. 3d, Attaching the lamp of a lantern to a hinged bottom, and connecting the latter to a spring in the top so as to keep the lamp securely in its place when in ordinary use, yet admit of ready access to it, as described.

121. CORN HUSKERS; N. T. Spear, Boston, Massachusetts.

Claim—The combination and arrangement of the toothed beveled wheel, provided with one or more faces, with the smooth conical rollers, one or more, and boards, when these several parts are united together and arranged for joint operation.

122. BREECH-LOADING FIRE ARM; E. T. Starr, City of New York.

Claim—Opening and closing the rear end of the barrel to insert and inclose the charge, by a plate turning on an axis below and in the plane of the rear face of the barrel, when this is connected and combined with a wedge, or its equivalent, operated by a lever below, so that in the act of drawing out the wedge to liberate the breech plate the rear end of the barrel shall be opened to receive a charge, and by the act of lifting or forcing up the wedge the charge shall be inclosed and the breech-piece secured, while at the same time all the injurious effects of expansion and contraction and of fouling are avoided.

123. COMBINATION STEAM VALVE; Robert Stewart, Elmira, New York.

Claim—The valve with the heads as guides or bearings fitting in chamber, in combination with the outer chambers and steam head against which valve, e, is pressed up, forming a steam joint operating as a self-adjusting valve, operating as described.

124. MAKING PLIERS; Chester W. Sykes, City of New York.

Claim—Connecting the jaws of the pliers or pincers to the portions of the handles above and below the centre pin or fulcrum, upon which they move by pins at points diagonal with each other, and at equal distances therefrom, the lower set of the said pins being inserted and allowed to traverse (with the opening and closing of the handles and jaws,) in longitudinal slots in the lower parts of the said jaws.

125. GATE; William Tobey, Naples, New York.

Claim—Opening and closing the gate by the use of the parallel pivoted levers, when arranged in the manner set forth.

126. BEDSTEAD; William S. Todd, Mechanicsville, Iowa.

Claim—1st, Attaching the ends of the side rails of the bedstead to the foot and head posts by the butt hinges, arranged in reverse positions with each other so as to enable the said side rails and the head and foot rails to be folded together almost parallel with each other. 2d, The combination of the right-angled brace or rod, groove in which it traverses, and turning winged or cam shafts, for disengaging the right-angled end of the said rod from the openings in the projections on the inner sides of the side rails.

127. PRINTING PRESS; Ervin B. Tripp, City of New York.

Claim—1st, The employment in connexion with the type cylinder of a cylinder or rotary printing press, of a flattened plate or type bed in which the type, to produce the printed impression upon the paper, are placed, which plate or type bed is revolved with that cylinder, and is so connected with and attached to it as to have the face of the type contained in it move over the impression roller in the arc of a circle. 2d, The feeding roll, operated by a positive motion, as specified, when combined with, and elevated and depressed by, the arms and cams, in the manner described. 3d, The feeding guide, o, operating in connexion with the feeding roll, as set forth.

128. PORTABLE FIELD FENCE; Archibald B. and Madison Vandemark, Phelps, New York.

Claim—The placing the locking batten on the same side of the rails with the end batten, and its combination therewith and with the locking batten and end batten, and forming a lock, substantially as described.

129. MODE OF FILLING WATER TANKS AT RAILWAY STATIONS; Charles Weed, Milledgeville, Illinois.

Claim—The combination and arrangement of the yielding track with the compound levers, connecting bars, or their equivalents, weighted segment lever, ratchet pinion, and gear wheels, as required, for giving motion to pump lever.

130. SCREW CUTTER; Thomas Whitaker, Cincinnati, Ohio.

Claim—The combination of the shaft, the sheaves, the yokes, and the guides with the dies, when arranged substantially as described.

131. APPARATUS FOR RAISING SUNKEN VESSELS; Aldridge Windham, City of New York.

Claim—The combination of the rigid and elastic inflatable air vessels, together constituting the raiser when so united, and so small as to be conveniently carried by any vessel which they can raise. Also, the portable shoe, so constructed of wood and iron, or other material, as to be managable under water, so as to be easily applicable to the sunken vessel to receive the cable for raising, and protect the vessel from abrasion or jamming by the cable. Also, the inflatable elastic stopper, so constructed as to be easily thrust through a leak or opening in the vessel, and afterwards inflated with air, which stops the opening, so that the sunken vessel may be exhausted of water to assist its raising.

132. GUARD FINGERS FOR HARVESTERS; John W. Brokaw, Assignor to Warder, Broker & Child, Springfield, Ohio.

Claim—The peculiar construction of the cap, when made of wrought or malleable iron, and connected to the cast iron base and to the finger bar, in the manner set forth.

133. MODE OF LAUNCHING VESSELS; Gordon Conkling, Assignor to W. T. Conkling, Conklingville, New York.

Claim—The runners, balls, and ways, combined and arranged substantially as set forth.

134. PRESSURE AND VACUUM VALVE; William Hardy and John Parkinson, Assignors to selves and Aaron Bates, Philadelphia, Pennsylvania.

Claim—The valve chamber, spring valve, and inner valve, with their respective openings and passages.

135. CAR SEATS AND COUCHES; Alexander M. Holmes, Assignor to self and Albert G. Purdy, Eaton, New York.

Claim—The combination and arrangement of the specific devices set forth, substantially as described.

136. SEWING MACHINES; George W. Hubbard, Assignor to self, Walter Hubbard, W. L. and N. L. Bradley, Meriden, Connecticut.

Claim—The looper composed of the fixed plate, the elastic plate, and the hook, applied to be operated by, and to operate in combination with, the needle.

137. MACHINERY FOR DRAWING AND TWISTING WOOL; John W. Kennedy and John T. Plummer, Plainfield, Assignors to selves and John Batchelder, Lisbon, Connecticut.

Claim—1st, The combination of the tubes, the toothed drawing rollers, and the convolute groove, to effect the draft and twist simultaneously, or either alone. 2d, Making the upper part of the frame which carries the back drawing rollers and the rollers, or their equivalents, which carry the roving to be drawn and twisted, adjustable vertically.

138. STONE-HOLDING MACHINES; Eleazor B. Knight, Assignor to self and Nathan Kellogg, Malden, New York.

Claim—1st, A box or holder, detachable from its guiding or supporting frame, and provided with sets, and means as recited for holding stones or other substances, to be operated upon in being rubbed or ground, and which can be adjusted to plain or beveled edges, and for angular pieces. 2d, The angular guides or standards, as arranged for keeping the box or holder in its proper position in relation to the rubbing bed. 3d, The adjustable rests or supports for keeping the box or holder at any point desired.

139. RAKING AND BINDING APPARATUS FOR HARVESTERS; Allen Sherwood, Assignor to E. P. Senter, Albert Goss, and Daniel Woodworth, Auburn, New York.

Claim—The traversing the double rake made to rock in its supports, to bring its fingers into and out of action, and automatically fastened and released. Also, in combination with the fingers for throwing the gathered gavel up into the concave, the arm for carrying the binding wire up and over the sheaf, and placing the wire in the slot of the twisting wheel. Also, in combination with the twisting wheel, the sliding knife for cutting off the wire. Also, in combination with the cutter bar and its stud, the cam, for the purpose of causing the cutter to act, regardless of the direction in which the shaft that carries the cam turns. Also, in combination with the wire carrier and guides, a twisting wheel, made and operated as described. Also, forming a knot or enlargement on the end of the wire, behind where it is cut off by the cutter, by twisting that portion of it by the means substantially as described, said twist preventing the end from being drawn through the slot of the twisting wheel.

140. PIN-STICKING MACHINE; Cornelius W. Van Vliet, Assignor to the New England Pin Company, Winsted, Connecticut.

Claim—1st, The combination of the series of channel ways with the sliding separator, when constructed as described. 2d, The combination of the punches with the sliding separator, when constructed as set forth.

3d, The combination of the crimping bars with the punches, sliding separator, and channel ways, when constructed as described.

141. HARROWS; Samuel White, Penfield, Assignor to Harlow Herrick, La Grange, Ohio.

Claim—The adjustable plates, C C, in combination with the revolving shafts, E E′ E″, and in connexion therewith the spur wheel, K.

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142. LOCK; Christian Ackerman, Newark, New Jersey.

Claim—The use of the fall and lever in their combination with the eccentric moving bolt, when constructed as set forth.

143. GAS REGULATORS; Salmon Bidwell, Chicago, Illinois.

Claim—The cock, operated by the diaphragm, rod, and spring, as described.

144. BRICK MACHINES; John Booth, Mobile, Alabama.

Claim—The chambers separated by the perforated floor, in combination with the spring blade, scraper, and reciprocating mould carriage.

145. SHEARS; Joseph A. Braden, La Grange, Georgia.

Claim—Making the blades of triangular form in their transverse sections and fitting them to the handles, so as to be capable of being turned therein to present three different pairs of edges in an operative position.

146. PLOUGH PRESS AND DRILL; T. E. C. Brimby, Simpsonville, Kentucky

Claim—The press, in combination with the drill for pressing and drilling the mould-boards of ploughs.

147. TRUSS PADS; C. Campbell, St. Louis, Missouri.

Claim—The application of pads made of gutta percha, in the manner described, for the prevention of the escape of viscera through hernial openings in the human body.

148. PORTABLE FIELD FENCE; P. S. Carhart, Collamer, New York.

Claim—1st, Constructing the panels of a portable fence, having their bearings on sills, or their equivalents below, shorter at their tops than their bottoms. 2d, In combination with panels constructed as described, the sills provided with one or more cross blocks, arranged to project between or on either side of the end battens of the panels, to support and guide them. 3d, The employment for tightening up the panels and uniting them firmly and expeditiously with the sill of the key or wedge, in combination with the brace or strap.

149. ROTARY PUMP; M. R. Clapp, Seneca Falls, New York.

Claim—The combination and arrangement of the revolving toothed pinion and cylinder, with the abutment, or its equivalent, cylindrical case, and internal gearing.

150. NUT MACHINE; R. H. Cole, St. Louis, Missouri.

Claim—1st, The arrangement of two knives whereby they are made to act simultaneously on each side of the bar, so as to cut the nut blank entirely off and deposit it between the vibrating jaws or formers. 2d, The arrangement of the vibrating dies or formers, whereby they are made to press the sides of the nut to the required form while carrying it from where it is cut off to where it is to be punched on the die. 3d, The spring, as arranged with the aforesaid jaws or formers, whereby they are opened by a yielding force. 4th, I do not claim facing the dies or punches with steel, as they are both made entirely of that metal—but I claim making them in three separate pieces or parts, substantially as described, so that I can renew one part and retain the other so as to economize material.

151. RAKING ATTACHMENT FOR HARVESTERS; P. S. Crawford, Marengo, Illinois.

Claim—The combination of the rakes, O P, the former being attached to the box, and the latter operated through the medium of the gearing placed within the box, and the bars and arm. Also, the supplemental or discharging rake placed over the rake, and used in connexion with the springs of rake.

152. EXPANSIBLE FLOATS FOR LIFE-BOATS; Charles Legros, City of New York.

Claim—Constructing the outer sides or side surfaces of the floats of some non-corrosive metal, while the top and unexplored surfaces are formed of rubber or other air-proof flexible material.

153. ROOFING CEMENTS; G. W. Cushing, Chicago, Illinois.

Claim—The roofing cement composed of asphaltum, coal tar, and the residuary gum specified, combined in about the proportions stated.

[The component parts of this cement are asphaltum, coal tar, and the pitchy residue known as "residuary gum," which is separated from the fatty substances in the manufacture of stearic acid for what are known as "star candles," or for other purposes.]

154. INKSTANDS; Samuel Darling, Bangor, Maine.

Claim—An inkstand, with a dripping cup or reservoir, arranged and constructed substantially as described.

155. BURGLARS' ALARM; A. W. Decrow, Bangor, Maine.

Claim—The slides, D E F, tumblers, G H I, bar or bolt, J, and an alarm formed of the clock movement and bell, combined and arranged to operate as set forth. Also, the particular manner, as shown, of operating the tumblers, G H I, from the slides, D E F, to wit: by means of the oblique ledges formed on the slides, and the adjustable pins which pass through the tumblers, whereby the tumblers are not only actuated but changes also allowed to be made, so as to require a varying movement of the slides in order to throw back the bolt. Also, connecting the tumbler, G, and bolt, J, with a bar, L, to serve as a check or supplemental device to give an alarm, in case an attempt is made to open the drawer by force, or otherwise, without tampering with the slides, D E F.

156. MACHINES FOR SORTING SILK OR OTHER THREAD ACCORDING TO ITS SIZE; Ira Dimock, Mansfield Center, Connecticut.

Claim—1st, A device by which the varying thickness of the thread is made to shift a traversing guide, or its equivalent, to distribute the thread upon a winding apparatus according to its thickness, consisting of two surfaces, one of which is caused to receive a reciprocating motion through the agency of variations in the

thickness of the thread passing between them—whether the said surfaces consist of the peripheries of an eccentric wheel and roller, as represented in the drawing and described, or have any other form which permits of their operation in an equivalent manner. 2d, The movable carriage with its opening and notches, applied in combination with the series of spools, and the bobbin or winder on which the thread has been distributed and arranged according to its size or thickness, and operating substantially as described, to stop the winding operation as the unwinding of the thread from said bobbin or winder varies beyond certain parts thereof.

157. CIGAR WRAPPERS; Henry Durell, Morisiana, New York.

Claim—The removal of the coloring and flavor of the plant, by means described, then reducing to pulp and thence to paper the fibrous or woody parts of the plant in any known way, and then re-charging said paper with the solution or volatile matters previously removed therefrom in order to prepare said paper to be used as wrappers for segars.

158. MACHINES FOR WASHING COAL; J. P. Evans, Borough of Hazelton, Pennsylvania.

Claim—1st, Forming a series of slits at the lower end of the corrugations, next the triangular openings, so as to enable the thin pieces of slate to discharge themselves automatically through them. 2d, The combination and arrangement of a tappet or tappets, with and in the relation to the corrugated bottom of the chutes, and the slits, and triangular openings at the lower ends of the same, over which they are suspended, as set forth, the said tappet or tappets being provided with adjustable weights to regulate their resistance to the coal. 3d, The arrangement of the upright pipe and right-angled perforated pipe at its lower end, in the relation to the corrugated bottoms of the chutes described, said perforations being formed on the lower portion of its periphery, as stated, for subjecting the coal to a thorough washing in its descent, as set forth.

159. PUMPS; S. H. Gray, Bridgeport, Connecticut.

Claim—Having the upright or stand of the pump handle provided with a claw or hook at one side of its lower end, and having a bolt pass through the lower part of the upright or stand, the bolt being provided with a curved or hook-formed head, the above parts being used in connexion with flanch on the upper end of the pump cylinder. Further, in connexion with the upright or stand, the cover, arranged as shown, so that it may be secured to the cylinder by the upright or stand, as described.

160. PUMPS; Foster Henshaw, Washington City, D. C.

Claim—1st, Operating the piston by a curved slot possessing the characteristic features described and arranged, or formed in a vibrating handle. 2d, In the construction of lifting pumps, the combination of three or more valves. 3d, The arrangement of washers, formed as specified, with the series of valves. 4th, Casting in the well pipe a series of steps.

161. APPARATUS FOR APPLYING SOLES TO BOOTS AND SHOES; Jacob Jenkins, Charlestown, Massachusetts.

Claim—The application of the rocker jaws or jaw-holders to the elastic bed, whereby the latter when forced downward is made to draw the jaws towards one another, in manner as explained. Also, the combination of the elastic cushion or sole pressure with the elastic bed, and a mechanism for forcing the shoe down upon the said bed. Also, the combination of the rocker-bearer and its screws with the holding lever, or its equivalent, and to operate therewith. Also, the contrivance shown in figs. 7, 8, and 9, and as above described, to be used in manner specified.

162. DENTISTS' CHAIRS; Alex. M. Holmes, Morrisville, New York.

Claim—1st, The foot-rest arranged with the slides, racks, pinions, and pawls, substantially as described. 2d, The supplemental back attached to links which are fitted in the slot of the back, and actuated by the set-screw, substantially as set forth. 3d, The adjustable head-rest formed of the slide, pinion, plates, arranged relatively to each other and applied to the back, substantially as set forth.

163. SMUT MACHINES; Hiram Hopkins, Evansville, Indiana.

Claim—The scourer constructed of the vertical bars provided with radial projections at their inner sides, and the arms provided with ledges and attached to the shaft, when said scourer thus constructed is enclosed by a box, and arranged relatively with the blast spouts and fan, to operate as set forth.

164. WASHING MACHINE; H. R. June, Millport, New York.

Claim—The combination of the revolving rubber having alternate slats and receding boards, as described, with the rubber. Also, the elastic pivot rod, operating in the manner set forth.

165. NEEDLES FOR KNITTING MACHINES; J. K. Kilbourn, Pittsfield, Massachusetts, and E. E. Kilbourn, Norfolk, Connecticut.

Claim—The improved knitting needle having a secondary groove in its stem, substantially as set forth.

166. MACHINE FOR CUTTING METAL BARS; D. R. Knowles, Centre Groton, Connecticut.

Claim—The bed piece provided with the clamp, B, block or rest, C, slide, D, having the cutting tool attached and connected with the lever, G, in combination with the automatic feed movement formed of the adjustable lever, H, pawls, ratchet, and screw shaft, connected with the block or rest, C.

167. BRUSH CYLINDERS FOR SPREADERS, COTTON GINS, &c.; A. M. Lampher, Gloucester, New Jersey.

I am aware that metallic fans have been used on the ends of a cylindrical brush in the cotton gin, as described in E. Carver's patent, and I am also aware that brushes have been arranged around the periphery of the end of the cylinder, and that such an arrangement was patented by B. D. Gullet, in 1858—but while I believe I can prove priority of invention over Gullet, I deem my arrangement essentially different from an improvement upon his, as it combines the advantages of the fans of Carver, with the protection against fire attained by Gullet. I therefore

Claim—The brushes on the ends of the cylinder, when arranged substantially as above described, for the purpose of preventing the filaments of cotton or other fibrous substance from becoming entangled in the journals and for preventing accidents by fire.

168. SELF-ACTING WAGON BRAKE; A. Larrowe, Cohocton, New York.

Claim—Constructing the rubbers with the flanches on each side operating loosely in grooves in bar, B, and resting on springs, h, for allowing the rubber to rise upon an inclined plane, and relieve the friction of the wheels when backing the wagon and for replacing the rubbers.

169. HORSE SHOE; John Maddock, Bloomington, Illinois.

Claim—A nailless horse shoe, provided with lugs, or their equivalents, formed on the upper side of the sole, when used in connexion with corresponding projections formed on the inner side of the upper flanch, the former being made to fit cavities formed in the horse's hoof, and the latter into grooves formed for their reception in the sole, the whole being secured together in the manner substantially as set forth.

170. Canal Boat; John McCausland, Kingston, and Jefferson McCausland and James McCausland, Esopus, New York.

Claim—The construction of canal boats and other flat-bottomed and vertical-sided vessels by, 1st, Interposing the bilge timbers between the floor timbers and the side timbers, substantially as and for the purposes set forth. 2d, Beveling the edge of the bilge timbers and forming a face on either side of the beveled face for the fitting on of the bilge plank in a gradually rounding line, as described. 3d, The second dovetail in the side timbers, with the chock between the dovetailed faces and the bilge timber, as an arrangement of means for adding strength to the vessel, as set forth.

171. Machines for Cutting Grass, &c.; C. H. McCormick, Chicago, Illinois.

Claim—The combination of the sickle having the scolloped or indented edge and serrated teeth, with a continuous series of fingers having the back reversed angles for supporting the grain or grass to be cut to the edge of the sickle, both above and below the edge or above the edge only. Also, cutting out the middle of the upper part of the fingers that project over the sickle, in combination with the vibrating sickle, as described.

172. Harvesters; McClintock Young, Jr., Frederick, Maryland.

Claim—The combination of the handle, shaft, arm, pitman, and guide, or their equivalents, when arranged in the manner specified. Also, making the gatherers adjustable on the arms of the reel, as specified.

173. Mode of Preventing Nuts from Unscrewing; S. Noblet, Halifax, Pennsylvania.

Claim—Preventing bolt heads or nuts from turning by inserting below them a flexible metallic washer, one end of which is turned against the head or nut, and the other held immovable in place.

174. Churn; Andrew Ralston, West Middleton, Pennsylvania.

Claim—The arrangement of the openings in the circular part of the fan or beater case, the valve, x, the gathering valve, h, the conductor, u, as described.

175. Lamps; C. Reichmann, Philadelphia, Pennsylvania.

Claim—In combination with the lamp, the slotted open bell-shaped cap, when so constructed as to allow light to be deflected downward, substantially in the manner set forth.

176. Rotary Harrows; Jabez Robins, Boston, Massachusetts.

Claim—The two harrows placed one within the other, and connected by the concave rollers and bead, in connexion with the draft beam and frames, provided with the rollers or weights.

177. Water Wheel; Alpha Smith, Sanquort, New York.

Claim—Constructing the bucket with ledges or prominences, the buckets being curved and fitted between the shells which form the body of the wheel, and arranged relatively therewith.

178. Rotary Valve for Steam Engines; Thomas Stewart, Philadelphia, Pennsylvania.

Claim—1st, Making a rotary valve with an independent cut-off applied thereto, constructed substantially in the manner set forth. 2d, Constructing the said rotary valve with two or more sets of ports or ways therein, for the induction and eduction of the steam, so as to enable me to cut off the said steam at any required part of the stroke, without producing any connexion with the opposite side of the piston when the steam is cut off short, as set forth.

179. Rotary Harrows; Salathiel S. Thompson, Heller's Corners, Indiana.

Claim—Attaching the toothed wheels to the frame formed of the bars, hinged together or connected at their front ends by a swivel joint, and having their back parts attached to bars connected by a pivot and secured in proper position by the segments and pins.

180. Eyelet Fastenings for Ladies' Skirts; W. S. Thomson, City of New York.

Claim—The use of the H-shaped washer or fastener, or equivalent, in combination with an eyelet as a means of fastening together the straps and hoops of elastic skirts.

181. Cotton Gins; John L. Tuttle, Bridesburgh, Pennsylvania.

Claim—So combining a toothed cylinder with an open breast that allows the fibre to pass through it, but holds back the seeds, as that the cylinder shall work against the edge of said open breast, and carry the fibre past it, whilst the seeds shall roll up against the surface of said breast, and draw the lint that has not been taken from them up through the openings, whence they are turned over and returned again and again by the action of the cylinder to the breast until divested of all their fibre.

182. Corn Planters; Charles Van Houten, Sunbury, Ohio.

Claim—1st, The employment of the hinged, adjustable, and laterally sliding hopper and share frames, furnished with a spring stop or catch, in combination with a long transverse pinion and the propelling axle. 2d, The combination of the hinged grated apron with the sub-soiling covering shares and furrow opener.

183. Machine for Cutting Veneers; Gilbert Bishop, Fairfield, Connecticut, Assignor to Edward White, City of New York.

Claim—1st, The cutting of veneers from opposite sides of the log by knives, arranged and operating in opposite directions, so as to cut with the grain of the wood. 2d, The construction and arrangement of the diagonally-faced side pieces and the sliding frames in connexion with the knives, so as to give the thrust of the knives into the centre of the log, and thus cut the veneer clear from the log. 3d, The arrangement of the wheels, in combination and connexion with the sliding frames and knives, so as to produce the drawing cut at the same time that the knives are being thrust in upon the log. 4th, The combination and arrangement of cam, the pair of bars, the connecting rod, vibrating arm, and pawl and ratchet, so as to operate in the manner described, to raise or lower the feed screws.

184. Apparatus for Coloring Paper, &c.; Charles Williams, Philadelphia, Pennsylvania.

Claim—Distributing or laying the color in the process of marbling or coloring paper, by means of an apparatus constructed so as to operate substantially in the manner described.

185. Skate Irons; C. A. and Robert Williams, and G. A. Morse, Bloomfield, Maine.

Claim—That portion of skate studs (solid to their runners) above the collars, upon which is cut the screw thread, in the manner substantially as set forth.

186. Gas Burners; A. H. Wood, Boston, Massachusetts.

Claim—The combination with a gas burner of metallic flanches or spreaders, arranged near and above the orifice of the burner, as described, for the purpose of spreading the flame and consuming the impurities of the gas, whereby the orifice is kept clear—and this I claim whether the conducting rods be used or not.

187. SAW MILL; John Pemberton, deceased, Assignor to Lemuel Pemberton, Jonesborough, Indiana.

Claim—I do not claim as new the devices below enumerated, but simply their relative arrangement, as specified, for the purposes set forth, to wit: 1st, The roller, T, ropes, t and u, to raise the bars, M and M', in combination with the pin, b, slide, X, lever, w', bar, N', and rock shaft, P, with its arms, rod, q, and lever, q', the whole being so constructed and arranged as to throw the feeding out, and the backing devices into gear, by operating the lever, e', and move the gate or valve to reduce the speed of the mill at the proper time, or after the saw cuts through the log. 2d, The arms, J, rock shaft, S', and bar, S, in combination with the projection or stop, e, connected to the lever, E, or its equivalent, to turn the ratchet wheel shaft and traverse the rack to set the log, as described. 3d, The ratchet wheel, F', bent lever and pawl, G, in combination with the pin, f, or its equivalent, in the lever, F, to stop the ratchet wheels when they have moved far enough, so as to prevent the log from being moved too far when it is set for a new cut. 4th, The pin, n, in the head block, and slide, X, in combination with the lever, W, which releases the hook, v', to let M' M descend to increase the speed of the mill, as described. 5th, The rod, a, and stop, L, in combination with the slide, Y, and lever, U, so constructed and operated as to hold up the bar, M, after the log is sawed, and prevent it from descending and increasing the speed of the mill, and at the same time stop the apparatus which sets the log.

188. TEA POTS; Wm. Austin, Assignor to self and Wm. Obdyke, Philadelphia, Pennsylvania.

Claim—The plunger or presser, in combination with the interior casing, the whole being arranged in the manner set forth, or any equivalent to the same.

189. AUTOMATIC PAPER FEEDER FOR PRINTING PRESSES; Wm. Bullock, Assignor to George W. Taylor, Newark, New Jersey.

Claim—Operating the hands, or their equivalents, which effect the feeding of the sheet of paper, in manner substantially as set forth, so that they have a greater capacity for moving the sheet than is necessary for the purpose. Also, controlling the operation of the hands, or their equivalents, upon the sheets of paper, by mechanism whose operation is dependent upon the position of the sheet being fed, so that the length of time during which the hands, or their equivalents, are permitted to act upon each sheet of paper does not bear any fixed relation to the movements of the other parts of the printing press. Also, intermitting the operation of the hands, or their equivalents, upon the paper, while the latter is being drawn into the press by mechanism acting substantially as set forth. Also, effecting the progressive movement of the pile of paper, by mechanism whose operation is dependent upon the position of the pile. Also, the combination of the flap guides and nozzles, or their equivalents, for stopping the movement of the forward edge of the sheet, and for releasing the same in the manner described. Also, moving sheets of paper by automatic rubbing hands, or their equivalents, constructed substantially as set forth. Also, operating the stop-cocks of the air cylinder and the flap guides by a cam, or its equivalent, whose movement is coincident with, or bears a fixed relation to, the movement of the fingers which draw the paper into the press.

190. SEWING MACHINES; Jonas Hinkley, Huron, Assignor to self and F. A. Wildman, Norwalk, Ohio.

Claim—1st, The method of operating the feeding arm or cloth mover, by the combined action of the pivoted bow, pressing lever, flexing strap, and vibrating plate, or its equivalent, as set forth. 2d, Mounting the vibrating plate which imparts motion to the loop-forming hook and feeding mechanism upon spring arms, arranged at right angles to a longitudinal spring for balancing said plate in its vibration. 3d, Mounting the spool upon a spindle having elliptical-shaped springs, which extend into and through the eye of the spool, as specified.

191. MACHINES FOR PEGGING BOOTS AND SHOES; B. F. Sturtevant, Assignor to self and Elmer Townsend, Boston, Massachusetts.

Claim—1st, Causing the hammer to descend each time a peg is driven a short distance below the stationary rest, for the purpose of compressing the soles, as set forth, and of relieving the shoe from contact with the rest, that it may be fed forward, as described. 2d, The arrangement of the hammer, x2, and stationary rest, H, constructed and operating as described, in connexion with the weighted lever. 3d, The peculiar holder for the blank, the same having several knife edges lying in the direction of the feed, operating in the manner set forth, to hold the last peg of the blank whilst it is being separated from the one preceding it. 4th, And in combination with the holder, the pawl, operating upon several points of the blanks, in the manner set forth. 5th, Sawing off the pegs in the machine by a saw operating into and through the trough, through which the pegs are fed. 6th, The spring in the end of the trough, operating as described.

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192. CORN SHELLERS; A. Adams Sandwich, Illinois.

Claim—The combination of the yielding plate and guide bar or plate with the wheels and spout, provided with the elastic plate, when these several parts are constructed and arranged for joint operation, and relatively with respect to each other and to the discharge passages, in the manner set forth.

193. SEEDING MACHINES; George C. Bunson and Cyrus Roberts, Belleville, Illinois.

Claim—1st, The employment or use of the cylinder, provided with step-like projections between circumferential flanches, oblique partitions, and zigzag grooves, said cylinder being fitted within a cylindrical case at the bottom of box, D, and having a reciprocating rotating motion. 2d, The arrangement of the adjustable tubes attached to the arms, as shown, the rollers and cutters, whereby both the cutters and tubes may be adjusted as desired, and the pressure on the cutters graduated as desired, as also the depth of the furrows made by the cutters.

194. MACHINE BELTING; John H. Cheever, City of New York.

Claim—The manufacture of belts or bands of a combination of india rubber or gutta percha with wire cloth or netting, or strands of wire.

195. EXPANSIVE BIT; Wm. A. Clark, Bethany, Connecticut.

Claim—1st, The combination of the follower, beveled upon its under side, in such a manner that driving it home against the cutter shall crowd it upward, with a lip or shoulder above it upon the shank, which lip or shoulder is so formed that this upward pressure mentioned shall crowd the upper edge of the follower in against the seat back of it, when the upper edge of the follower is beveled to correspond, as set forth, for the purposes stated, the follower being brought home to its place by a screw, or in any equivalent manner. 2d, So arranging the movable and stationary cutters in relation to each other and to the other parts, that all the chips made by the instruments shall be delivered upon one and the same side of the shank of the bit, thereby allowing the back side of the shank of the bit to be left entire.

196. PLOUGHS: David Cockley, Lancaster, Pennsylvania.

Claim—The adjustable cutter wheel, cleaner, and devices, V X Y Z, when arranged with the regulator in combination with the beam Also, the manner of arranging and fastening the point, share, and landside with its cutter, so as to hold them with the short screw and plate, in combination with the mould-board and beam.

197. MAKING NUT BLANKS; Richard H Cole, St. Louis, Missouri.

Claim—Preparing the nut blank by driving a punch into it while it is confined against a blank surface, by means of the mechanism constructed and arranged substantially in the manner set forth.

198. COUCHES FOR RAILROAD CARS; J. B. Creighton, Tiffin, Ohio.

Claim—The combination of the couches, folding partitions, stretchers, slatted supports, hooks, and pins, the whole being arranged in the manner set forth.

199. SUGAR MILLS; Samuel L. Denney, Lancaster County, Pennsylvania.

Claim—The combination of eccentric bearings, their arms, connecting rod, lever, sliding belt, hand piece, and arch, or their equivalents, substantially in the manner set forth.

200. ATTACHMENT FOR TACKLE BLOCKS; George Focht, Reading, Pennsylvania.

Claim—So attaching a tackle block that it may turn freely in all directions, and be retained in the proper relative position with the rope when the strain on the rope ceases, in the manner described.

201. TEMPERING STEEL CAR SPRINGS; Perry G. Gardiner, City of New York.

Claim—1st, The subjecting the oil or fluid divided into streams or showers to the contact of a blast of cold air while falling, by means of the cylindrical chambers or compartments, and the cylindrical air chamber, operating as described. 2d, The construction, arrangement, and combination of the cylindrical chamber, G, the cylindrical chamber for distributing the air, H, and the disk and perforations, as described. 3d, The arrangement and combination of the tanks, A B, and the coils of tubes or worms, the chambers, G H, and their connexions, operating together, so as that at the same moment the oil or fluid is subjected to the cooling by both air and water, as described.

202. COMPOUND RAILROAD AXLES; I. P. Garrett and Daniel Steckel, Mercer Co., Pennsylvania.

Claim—A compound axle, the main portion of which extends through both wheels, and equals in length the width of the track, and is reduced in size from the centre to one end, in combination with a tubular axle of half its length, in which the reduced part of the main axle revolves, as in a journal, one wheel being secured to the main axle, and the other to the tubular part, arranged substantially as described.

203. METALLIC FRAMES FOR VAULT LIGHTS; Michael Grasz and Peter H. Jackson, City of New York.

Claim—The Π-shaped metallic bars receiving the glasses, in combination with the wrought iron bars of a grating, over which the said Π-shaped bars set and are sustained, substantially as specified.

204 CRACKER MACHINE; J. and J. C. Holyland, Rochester, New York.

Claim—The arrangement and combination of the socket, arm, spring, and rod, as described.

205. MOWING MACHINES; George F. and Moses Jerome, Mineola, New York.

Claim—1st, The caster wheel, when attached by the shoes, or their equivalents, by having its arbor pass loosely through a socket attached to the cross-bar, and having a swivel at the upper end of the arbor, so that by the aid of pulleys, or other guides, and a chain or cord, the weight of the finger bar and sickle will be transmitted to the caster wheel, and the finger bar and cutter raised and lowered, while the caster wheel is allowed to turn freely in any direction without affecting in any degree its concomitant parts. 2d, The lever and spring, in combination with the chain or cord, caster wheel, and shoes, when the whole are arranged substantially as set forth.

206. COMBINED COOKING RANGE AND HEATING APPARATUS; Charles Kane, City of New York.

Claim—The arrangement of an air chamber under the whole range, with a flue or flues connecting it with the hot air chamber, together with the double flues in double tiers between the air chamber and the bottom of the ovens, through and in which last mentioned flues the combustible gases and smoke circulate before reaching the smoke flues.

207. BALANCE SAIL RIG FOR SHIPS; John Lewis, Elizabeth City, New Jersey; patented in England, September 4, 1855.

Claim—The spring beam applied between the pyramidal frame or shears and the sides of the vessel, and connected to both the frame and vessel, in substantially the manner specified. Also, constructing a frame to receive sails by the horizontal yards, combined with the double ranges of spars and braces, whereby the said yards are permanently sustained at the desired distances apart, and a clear space is left from end to end of said yards for spreading the sails, without their coming in contact with the said spars and braces. Also, the sail frame, constructed as aforesaid, and combined with the pyramidal shears by the joint near the middle of said sail frame, whereby the aforesaid sail and frame are sustained, and permitted to be turned in the manner and for the purposes specified.

208. METHOD OF HEATING OVENS BY STEAM; Hamilton Lyon, Cincinnati, Ohio.

Claim—The combination of the pipes, chambers, and exhaust, or their equivalents, arranged substantially in the manner set forth.

209. MECHANICAL POWER; Elisha Matteson, Troy, New York.

Claim—The arrangement of gearing, in combination with the shaft, weight, and wheel, substantially as set forth.

210. HARVESTERS; David S. McNamara, North Hoosick, New York.

Claim—1st, Constructing the frame of the machine of the bars, end piece, and finger bar, in connexion with the trusses, substantially as set forth. 2d, In combination with the frame, constructed as above, the shoe, when constructed as described, and secured to the finger bar and end piece, in the manner set forth.

211. DREDGING MACHINE; Abel Minard, City of New York.

Claim—1st, The combination of the spring catch, lever, and curve, with the lid or shutter of the bucket, for the purpose of tripping the lid to empty the bucket of its contents, as described. 2d, The attachment of the dredge wheel, the engine, and chute, to the hinged frame or platform, as described, which attachment allows the chute to retain its relative position to the dredge wheel at all points of the latter's elevation, and the engine to be connected to the wheel to work it at all points of its elevation, without the intervention of other connexions or gearing than that shown.

212. Cast Iron Car Wheels; Hiram W. Moore, Jersey City, New Jersey.

Claim—My described cast iron car wheel, the hub of which is made of an inner and outer straight cylinder joined together by concentric plates at their ends, and an intermediate plate between, for imparting great strength and durability to the wheel, and in combining and uniting such hubs to the rim or tread by straight plate radiating therefrom, between the end of the hub and intermediate disk, or connexion otherwise formed, in order that every portion of the wheel may be of a uniform thickness to cool even, be durable, and cheaply constructed, and to render hooping of the hub unnecessary.

213. Ambulance Wagon; Israel Moses, City of New York.

Claim—An army ambulance, having ability to transport the sick and wounded under cover, either lying or sitting, by means of a system of sectional folding seats, arranged along the sides, as described, as also for carrying the surgeon's medicines and implements in removable cases, fitting in and under said seats, and arranged in drawers under the body of the vehicle, so that said cases may be used for general or detached service, as required; and also the arrangement of an adjustable door, capable of serving as a table, as set forth, together with the arrangement described of the hammock for one, two, or more persons; and finally, in combining with the vehicle as a central support, the tent necessary for the hospital camp, the whole being combined and operating as a connected device for transporting, subsisting, and protecting the sick and wounded of an army, and their appropriate attendants, as set forth.

214. Key-hole Stop; John Moulson, Philadelphia, Pennsylvania.

Claim—The construction of a key-hole stop, consisting of two pieces of metal, one to slide into the other, which, when introduced into a key-hole, first the female and then the male piece, in conjunction with a lug on one piece and a padlock on its equivalent, through both pieces, all combined as described, or their equivalents, will fill the key-hole and effectually prevent depredations on locks, by preventing the introduction of any unwelcome key or other instrument therein.

215. Lamps; W. Mulholland, Brooklyn, New York.

Claim—The arrangement of the central air tube, B, extending through the body, A, of the lamp, and communicating at its lower end with the rack, a, provided with a register, c, and perforated plate, a, with the wick tubes, c c, placed at opposite sides of the air tube, B, and the perforated cap, D, provided with the deflector, f, as set forth.

216. Machine for Planing Irregular Surfaces; James H. Nelson, Oskaloosa, Iowa.

Claim—The combination of the elastic or yielding frames, B B I, provided respectively with planers, G G, and feed rollers, K, and arranged relatively with each other, so as to operate as set forth.

217. Bread and Cracker Machines; Wm. R. Nevins and Joseph J. Yates, City of New York; patented in England, March 13, 1857.

Claim—1st, Extending the endless apron, H, for the conveyance of biscuit or crackers, and oval or angular bar, J, over which it passes, beyond the end of the frame, A, and arranging the same in the relation to the hexagonal roller over which the endless metallic apron, H', of the oven passes, and which has a corresponding intermittent progressive motion with the endless apron, H, in the manner described. 2d, Combining and arranging with the lower endless apron, H, in the relation described, the upper endless apron, D, for separating the scraps from the biscuit, as described, the two aprons, H D, being made to move together by means of the ratchet wheels, notched bars, and oscillating arm or bar attached to rock shaft, which may be actuated by an eccentric or other convenient means, as set forth.

218. Bakers' Oven; Wm. R. Nevins and Joseph J. Yates, City of New York; patented in England, March 13, 1857.

Claim—The combination and arrangement of the endless apron, H', and hexagonal rollers, H, to which an intermittent progressive motion, corresponding with the motion of the apron of the cracker or biscuit-cutting machine, is given, horizontal flues and bridge wall between the lower flues and furnaces.

219. Machine for Adding Numbers; John B. Newbrough, St. Louis, Missouri.

Claim—The obstructing wheel, containing a successive number of slots corresponding to the circles of figures on the dial, when arranged in combination with the dial, to produce the result as shown.

220. Machines for Sawing Marble, Stone, &c.; James Norman and Aaron R. McLean, West Dresden, N. Y.

Claim—The carriage, as constructed of the parts, E E' and F F', with the means for holding and adjusting the same, and for holding and adjusting the stone thereon, in combination with the endless saw.

221. Revolving Fire Arm; Wm. Palmer, City of New York.

Claim—The combination of the trigger, hammer, seer or hair trigger, and slotted plate, or its equivalent, whereby the hammer is cocked by the pull of the trigger, and then disconnected therefrom, so that the strain is transferred from the trigger to the hair trigger, and then the latter is disconnected by the further pull of the trigger, as set forth.

222. India Rubber Car Springs; Sanford Peatfield, Ipswich, Massachusetts.

Claim—The application in the construction of car springs, of the combination knit and rubber fabric specified, in the following manner, to wit: the combination knit and rubber fabric being wound in several layers tightly round a central axis or "former," or placed flatwise, layer upon layer, over the axis or former, and afterwards pressed and acted upon by heat until it becomes a compact or united universally yielding mass, as set forth.

223. Cultivators; Thomas Wm. Poole, Brunswick, Ohio.

Claim—The combination and arrangement of the hinged arms, and fixed concentric guards, in the manner specified.

224. Clothes Dryer; Emma T. Porter, Washington City, D. C.

Claim—The combination of the adjustable frame and supporting braces, with the pivoted stand or foot-piece, substantially as specified.

225. Lamps; Wm. H. Racey, St. Augustine, Florida.

Claim—The case, provided with a cap and used with or without the external case, 1, the case and cap being placed relatively with the frame, as described.

226. Riddles for Threshing Machines; F. W. Robinson, Richmond, Indiana.

Claim—The plate with lips or tongues, as described, in combination with slats, for the purposes set forth.

227. Method of Laying Submarine Telegraph Cables; Samuel Samuels, Brooklyn, New York.

Claim—Passing the cable from the ship or vessel through the bottom thereof, at or near the point specified. Also, the employment, to conduct the cable to the bottom of the vessel, and to exclude the water from the opening in the bottom where the cable leaves it, of a tube, the whole or the lower part of which has a downward inclination toward the stern of the vessel, as specified.

228. Ploughs; B. B. Scofield, Andover, Illinois.

Claim—The arrangement and combination of the pivoted bar, share, landside, standard, curved rack, pinion, and lever, as described.

[This invention consists in combining a sulkey with a plough in such a way that a person while sitting therein, and merely driving the horses, may plough equally as well as by grasping the handles of the ordinary plough, and guiding it by that means.]

229. Railroad Switches; Charles L. Spencer, Providence, Rhode Island.

Claim—The use of two frog guiding rails, having the tread rails immovable, but an inside movable section of each guiding rail capable of working simultaneously together, for the purpose of influencing the course of a train of cars when proceeding in one direction, and of preventing injurious consequences in case the switch is improperly set when the train is proceeding in the opposite direction.

230. Rotary Pump; B. T. Trimmer, Rochester, New York.

Claim—The construction of the triangular reciprocating butments, working in grooves in the case, f f, with arms clasping around the edge and into the annular recesses of the loose piston, to admit of the butment accommodating itself to eccentric action of the piston without materially obstructing the motion thereof, and at the same time packing against its seat and the periphery of the piston, by the pressure of the water on its double inclined surfaces. Also, the combination and arrangement of the two cylinders or cases, A A, cams, pistons, and butments, with the chambers, C E, and ports, b b and c c, whereby the parts will operate conjointly, for the purpose described, or either cylinder work independently of the other, substantially as set forth.

231. Embroidery and Sewing Stand; Wm. H. Trowbridge, Saginaw City, Michigan.

Claim—The combination of the plate, the spring, the screws, the thumb-screws, the box, the spool rack, arranged substantially as described.

232. Method of Laying Submarine Cables; Owen G. Warren, City of New York.

Claim—The use of a reel immersed in the water to deliver a telegraph cable at the bottom of the sea, constructed and operated substantially as described. Also, the combination of the reel boat with the reel for the convenience of using the brake or operating engine, in the manner described.

233. Machine for Making Wire Springs for Furniture; C. A. and S. W. Young, Providence, Rhode Island.

Claim—A single grooved roll, in combination with the upright rod, to effect the coiling of the wire. Also, varying the diameter of the coils to produce a bi-conical form in the spring by causing the roll to approach and recede from the coiling rolls in a direct or curved line horizontally, substantially as specified.

234. Locks; T. B. Pye, City of New York.

Claim—The tumblers, slotted as shown, provided with projections, and used in connexion with a shackle, or its equivalent, in combination with the bar and spring, the above parts being arranged to operate as and for the purpose set forth.

235. Churn; G. L. Farrington, Assignor to D. B. Tiffany, Xenia, Ohio.

Claim—The employment of the double concavo-convex dashers, constructed in the manner specified.

236. Blind Operator; J. A. Dorman and J. E. Stearns, Assignors to J. A. Dorman, Worcester, Mass.

Claim—1st, The combination of the rod, slide piece, and spring, with the catch plate and knob, when constructed as described. 2d, The manner of holding the blind down in place by combining with the stud, the projection fitting into the recess, as specified.

237. Clothes Dryer; E. G. Gibson, Assignor to H. G. Finkham, Oswego, New York.

Claim—The arrangement of the square or box head between the pieces of the arms, as described.

238. Hangers and Boxes for Shafting; F. W. Howe, Newark, New Jersey, Assignor to the Newark Machine Company.

Claim—In combination with such a hanger, the self-adjusting box, in the manner set forth.

239. Cutting Threads of Wood Screws; H. L. Kendall and H. P. Hunt, Assignors to the New England Screw Co., Providence, Rhode Island.

Claim—The cutting of the threads of wood screws by means of chasing tools whose cutting edges have profiles which are respectively counter parts of the body and sloping portions of the screws, and which are caused to act in succession upon the screw blank.

240. Seed Drills; Alexander Turner, Assignor to self, R. Bess, and H. Sloane, Franklin, Indiana.

Claim—The arrangement of the seed boxes, the driving, secured as described, and the lever, wheels, rod, and seed slides, the whole being constructed in the manner described.

241. Roofing Machine; E. Wise, Hannibal, Assignor to self and C. L. Wood, St. Louis, Missouri.

Claim—The combination of the adjustable wheel, C, with the two wheels, B B, as described. Also, the combination of the two connecting rods with the lever and the axles. Also, the arranging of the wheels, B' and B', against yielding bearings, substantially as described.

Additional Improvements.

1. Revolving Fire Arm; F. D. Newbury, Albany, New York; patented June 29, 1858; additional dated September 28, 1858.

Claim—In the construction and use of the trigger, the slot, also the feather with the pin, substantially as described.

2. Corn Planters; Nathaniel Drake, Newton, New York; patented February 2, 1858; additional dated September 28, 1858.

Claim—1st, The rib attached to the upper valve, constructed as described. 2d, Extending the chain

which operate the valves down under the pulleys back of the axle, so as to obviate the slackening and taking up of the chains by the vibrations of the ploughs and their attachments, as set forth.

3. SWING BOLT FOR FASTENING SHUTTERS; J. Gunner, Jr., City of New York; patented Sept. 15, 1858; additional dated September 28, 1858.

Claim—The attachment, when used in combination with the lever, hub, and catch plate, for the purpose set forth.

RE-ISSUES.

1. SIDEWALK PAVEMENTS; John B. Cornell, City of New York; patented April 28, 1857; re-issued September 7, 1858.

Claim—Giving such a shape to the described street gutter section, that its under surface will securely embrace the top of the wall, whilst its upper surface at the same time forms a portion of the street gutter, and also a firm supporting base for a section of street curbing, or its equivalent. Also, forming a sidewalk pavement of a series of metallic plates, when the said plates are combined with, or form portions of, sections of metallic street curbing.

2. TRAP FOR CATCHING FLIES; Joel B. Fuller and George W. Pierce, Worcester, Massachusetts; re-issued September 7, 1858.

Claim—The combination of the wheel or cylinder, having a rotary motion, with the box or case.

3. CARTRIDGES; Gilbert Smith, Buttermilk Falls, New York; patented June 30, 1857; re-issued September 14, 1858.

Claim—Making the cartridge case, or at least the cylindrical portion thereof, of some impermeable and elastic substance, such as india rubber or gutta-percha, so that it may be expanded laterally by the force of the explosion of the charge, and will contract itself after the explosion by its own inherent property.

4. SEWING MACHINES; T. J. W. Robertson, City of New York; patented May 22, 1855; re-issued September 14, 1858.

Claim—1st, So arranging and operating a looper, or its equivalent, that it shall derive its motion from the movement of the needle. 2d, Moving the looper up to and away from the needle.

5. SEWING MACHINES; James Harrison, Jr., City of New York, late of Milwaukie, Wisconsin; patented April 11, 1854; re-issued September 14, 1858.

Claim—Clamping the thread of the needle at the downward or advancing movement of the needle by the means that are operated intermittingly. Also, combining with the clamping means a set-screw, or its equivalent, for adjusting the clamping means, so that the tightening of the stitch may be regulated to the degree required. Also, the combination of the drag bar attached to the shuttle, and containing the eye through which the thread passes therefrom, the opening for throwing the said bar into position to prevent the delivery of the thread from the shuttle, and the adjustable liberating piece, for preventing the delivery of the thread from the shuttle, and allowing the desired quantity to be given out. Also, constructing the shuttle in two parts, viz: the shell and cap, of which the latter is inserted into and withdrawn from the former, as described.

6. TACKLE; Joel Bryant, Brooklyn, New York; patented April 7, 1857; re-issued Sept. 21, 1858.

Claim—The construction and use of winches, whose bosses or drums, turned by cog-wheels, operate in connexion with certain sheaves, wheels, or pulleys, for carrying, operating, and sustaining the fall or tackle used in hoisting or lowering the sails or cargo of vessels on shipboard, substantially as described.

7. RAILROAD CAR SEAT; J. B. Creighton, Tiffin, Ohio; patented May 18, 1858; re-issued Sept. 21, 1858.

Claim—1st, The employment of the movable backs of car seats, when used for the purpose of filling up the spaces between the seats, so that a bed may be formed—and this I claim whether accomplished in the manner shown, or in any other manner substantially the same, whereby the same result is accomplished. 2d, The described method of forming and concealing, when not in use, in the spaces between the windows, an upper tier of beds, the same in arrangement with the device constituting the subject of the first claim.

8. TREATING SULPHURETS; Alfred Monnier, Camden, New Jersey; patented August 11, 1857; re-issued Oct. 6, 1857; re-re-issued September 21, 1858.

Claim—The process of treating native metallic sulphurets or arsenical sulphurets, in connexion with the substances above described, in order to expel all or part of the sulphur and arsenic, for the purpose of obtaining therefrom sulphuric acid, and the metals, as sulphates or oxides,

9. SHINGLE MACHINE; James Crary, Middleport, Ohio; patented November 24, 1857; re-issued Sept. 28, 1858,

Claim—1st, The use of two or more froes, arranged substantially as before described, for the purpose of riving two or more bolts from the block of wood at the same time, thus preventing the tendency of the wood to eat out or split too thin at one end or at either side. 2d, The use of brace bars, or their equivalents, so arranged in combination with the froes, as that the froes will encase themselves between them, thus securing the perfect separation and delivery of the bolts from the block. 3d, The use of sliding side pieces with conveying slots, in combination with the upright grooves in the frame in which the wrists of the shaving knives are inserted, for the purpose of effecting the gradual approximation of the shaving knives in the proper taper of the shingles. 4th, The combination of the lever with its pin, the projecting cam, s, and cam, g, on the frame, for the purpose of communicating the requisite relative motion to the vibrating feed board, the driver, and frame, whereby one bolt only at a time of the two, three, or more riven by the froes, is driven outward, and forced through the shaving knives, no matter how short or thin the bolt may have been froed.

10. MAGNETIC PRINTING TELEGRAPH; R. E. House, Binghampton, New York, formerly of the City of N. Y.; patented Dec 28, 1852; re-issued Sept. 28, 1858.

Claim—1st, The employment of force derived from an electro-magnet, to govern and regulate a force derived from the use of compressed air or other fluid, substantially in the manner specified. 2d, An electro-magnet, when made up of a series of hollow, stationary, and moving magnets, arranged so as to effect the movement of a rod or axis on which the latter are mounted. 3d, A valve, in combination with any electro-magnet to move that valve, and a piston, or its equivalent, whose motions are effected by the pressure of air or fluid, whose action is controlled by such a valve, the combination being substantially such as specified. 4th, An endless band, acting as a reservoir of coloring matter, and arranged substantially in the manner specified, in combination with paper and a series of types, and a spurred cylinder, so as to record characters when pressure is applied. 5th, In combination with a key-board at one locality, and a printing apparatus at another,

or in combination with both a key-board and a printing apparatus at each locality, I claim a detent or stop moved by the hand of the operator for arresting the motion of a type-wheel at one determined and fixed point, when there is combined therewith a key corresponding, the parts are in proper position with that determined and fixed point, the detent and key being substantially such as specified. 6th, Driving a type-wheel of a printing apparatus, by means of a friction connexion between it and a prime mover, so that the motions of the former may be modified, or its motions stopped, without causing the motion of the latter to be stopped or modified. 7th, Combining with a wheel of a printing telegraph, which must at times stop, and at other times be in motion, a spring, compressed by the action of the parts when in motion, and exerting its force to start the wheel, when released from any detent that may arrest its rotation, the combination being substantially such as to effect the purpose set forth. 8th, Causing the paper to be printed to approach the type which is to impress it, by means of a friction connexion with a prime mover, so that the latter may remain in motion while the former is at rest. 9th, The apparatus, substantially as set forth, for governing the approach of paper to a type-wheel, that at times moves and at others stops, so that the apparatus which brings up the papers shall act for that purpose when the type-wheel ceases to revolve for a longer period than usual. 10th, In combination with a type-wheel of a printing telegraph, a spurred or toothed cylinder, substantially such as is specified, the latter causing the paper to progress, as the purposes of printing by the types on the former may require—and this I also claim, in combination with another surface to press the paper upon such spurs, in the manner substantially as described.

11. Metallic Packing for Steam Pistons; Daniel Lasher, Brooklyn, New York; patented June 30, 1857; reissued September 28, 1858.

Claim—The bent or folded springs inserted between the piston and packing ring, and taking an even and extended bearing around the interior circumference of said packing ring, to cause the said packing ring or rings to take an uniform bearing on the interior of said cylinder, substantially as set forth. Also, two or more tiers of packing springs placed between the piston and the rings, as aforesaid, when the said tiers of springs are so placed as to occupy alternate positions or break joints, as set forth.

Designs.

1. Cooks' Oven Stove; Wm. W. Stevens, Westbrook, Assignor to Nathaniel P. Richardson & Co., Portland, Maine; dated September 7, 1858.
2. Stoves; Nathaniel P. Richardson & Co., Portland, Maine; dated September 7, 1858.
3. Cast Iron Bedstead; Philip Tabb, City of New York; dated September 14, 1858.
4. Nursery Bottle; Francis Kern, Sandwich, Massachusetts; dated September 14, 1858.
5. Stoves; G. Smith and H. Brown, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated September 21, 1858.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Binocular Vision.

Of the thousands who gaze with delight upon the magical effects produced by that small instrument known as the stereoscope, how few there are who comprehend, or attempt to assign reasons for, the extraordinary optical illusions experienced through its instrumentality.

It is with the view of, in some degree, elucidating the principles of vision upon which these are founded, that the following article is written.

It will in the first place be well to consider the difference between monocular and binocular vision. Nature has furnished us with several means of determining the distance of objects which may happen to come within reach of our visual organs. One is that of distinctness; a greater or lesser degree of which—other things being equal—gives an idea of greater or lesser distance in the object viewed. The second is through the change of focus required in the lens of the eye in refracting to a point on the retina, rays of light entering it with a greater or lesser degree of parallelism, thus producing in the brain a consciousness of unequal distances in the objects from which they emanate.

The means above alluded to, it is evident, are enjoyed in almost the same degree when viewing with one eye as where both are used.

By far, however, the greatest power with which nature has endowed

us of discriminating distances, is through the agency of binocular vision; or in other words, in the sensation produced in the brain by the different degrees of convergency of the optic axes required in obtaining distinct vision of the differently distant points of objects upon which they are directed. It is to this faculty that we are indebted for our most palpable evidence of differential distances, and for that consciousness of solidity and relief so remarkably experienced in the stereoscope.

It is evident, for example, when we are looking at a house or other object that has depth as well as breadth, from such a point of view as to enable us to see two sides of it at once, that we receive a differently perspective image upon the retina of either eye, or that we must see more of one side and less of the other with the right eye than with the left, or vice versa. Thus accomplishing with one view what a person with but one eye would require two views at positions 2½ inches apart —the distance between the eyes—to accomplish. These are the differently perspective views of the stereoscopic cards, and it is the effort to reconcile these dissimilar pictures by converging the optic axes at points differently distant from the eyes which produces the wonderful effect above alluded to, and which enables us to experience all the sensations of delight which would be produced by the contemplation of the landscape itself.

The stereoscopic pictures will of course never quite correspond. They are taken simultaneously with a camera constructed with two lenses, or consecutively with a camera with one movable lens.

The lenses of the stereoscope, besides magnifying the pictures, are so placed as to unite certain similar points of them, thus relieving the eyes of too great effort in uniting them entirely by convergency of the axes.

The means above alluded to, by which we are enabled to judge of differential distances, are of course much diminished by the distance that the objects viewed are removed from us.

Our consciousness of different distances by distinctness is diminished through decrease of light.

Our judgment through change of focus, is diminished in consequence of the parallelism of rays from distant objects being so nearly the same as to require but little change in refracting them to a point on the retina. And lastly, the binocular effect is in a great degree impaired through the identity of distant views when seen from positions only separated by a base of 2½ inches.

Nature has thus observed her usual economy in providing for our necessities alone. It being of little comparative importance to us generally, to be acquainted with the relative positions of distant objects, whereas our personal convenience and even safety depend greatly upon our knowledge of those near at hand. We are therefore provided with much more ample means of determining the latter than the former.

It may not be out of place here to allude to another subject immediately connected with vision.

Sir David Brewster says, in allusion to the cause of erect vision from an inverted image, "That it has long been a problem among the learned." And further remarks, "That it is perfectly explained by the law of visible direction." Now, although it is evidently a consequence of that law, the question arises, why should we see objects in a direction perpendicular to the retina at the point where their image meets it?

In truth, it is one of those facts that requires no explanation, as there is nothing inconsistent or irrational in it.

There is no more reason that an inverted image should give us the idea of an inverted object, than that the reverse should be the case, or that it should give the idea of a horizontal one. There is no unity necessary between the direction of an object and the direction of its image upon the retina. Nature has so associated impressions upon the retina with impressions on the brain, that an inverted image on the former is evidence of an erect object to the latter. And we have no consciousness of anything to the contrary. W.

Germantown, Penna.

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*On the Thermo-electric Series.** By AUGUSTUS MATTHIESSEN, Ph. D.

Being enabled by the method described in the "*Philosophical Magazine*" (Feb., 1857), to obtain wires of the metals of the alkalies and alkaline earths, I have determined their places, together with those of most of the other metals, in the thermo-electric series.

If A, B, C are different metals, and (AB), (BC), (CA), the electromotive powers of thermo-elements formed out of each two of these metals, whose alternate soldering points are at two different temperatures, so is $(AB)+(BC)+(CA)=0$, and therefore

$$(AB)=a-b,$$
$$(BC)=b-c,$$
$$(CA)=c-a,$$

where the values a, b, c, not only depend on the two temperatures, but also on the nature of each of the metals A, B, C. As the differences of the same constitute the electromotive powers, the value for either of these metals may be put $=0$.

If the temperatures of the soldering points of a thermo-element only vary slightly, the electromotive powers may be said to be in ratio with the difference of the two temperatures, and under the same conditions the values a, b, and c are also in ratio with the difference of the temperatures, and their relations to each other therefore independent of the same.

If now the value of the second metal relative to the above value of the first be taken equal to 1, the values of the others, in relation to these, become constants, and only depend on the nature of each metal; these values I will call the Thermo-electric Constants. The results obtained are given in the following Table, where the thermo-electric

* From the Lond. Edin. and Dublin Philo. Mag., Sept., 1858.

constant of chemically pure silver is taken = 0, and that of a certain commercial sort of copper = 1.

Bismuth (commercial, pressed wire),	+35·81
" (pure pressed wire),	+32·91
Alloy of 32 parts of bismuth and 1 part of antimony (cast),	+29·06
Bismuth (pure, cast),	+24·96
" (crystal, axial),	+24·59
" (crystal, equatorial),	+17·17
Cobalt No. 1 (a pressed specimen prepared by Prof. Duflos, and from the Collection of the Heidelberg Chemical Laboratory),	+8·977
Potassium (the same as used for the determination of its electric conducting powers for different temperatures),	+5·492
Argentine (wire of commerce, hard),	+5·240
Nickel (commercial, free from cobalt, but containing iron, &c.),	+5·020
Cobalt No. 2 (from the Collection of the Heidelberg Chemical Laboratory),	+3·748
Palladium (wire, hard, from Desmoutis, Chapuis & Co., of Paris),	+3·560
Sodium (the same as used for the determination of its electric conducting powers for different temperatures),	+3·094
Quicksilver (pure, fused in a glass tube),	+2·524
Aluminium (from Rousseau frères of Paris, wire-drawn, analyzed by Dr. G. C. Caldwell, and found to contain Si 2·34, Fe 5·89, and Al 91·77),	+1·283
Magnesium (wire, pressed),	+1·175
Lead (pure, pressed wire),	+1·029
Tin (pure, pressed wire),	+1·000
Copper No. 1 (wire of commerce annealed, containing appreciable quantities of zinc, tin, lead, and nickel),	+1·000
Copper No. 2 (wire of commerce annealed),	+0·922
Platinum (wire from Desmoutis, Chapuis & Co., of Paris),	+0·723
Gold (wire, hard drawn, purified by Dr. C. Meyboom),	+0·613
Iridium (from the Collection of the Heidelberg Chemical Laboratory),	+0·163
Antimony (wire, pressed specimens, purified by Dr. W. P. Dexter and Dr. G. C. Caldwell),	+0·036
Silver (pure, drawn, hard),	0 000
Gas-coke (from the Heidelberg Gas Manufactory, the hard mass remaining in the retorts),	−0·057
Zinc (pure, pressed),	−0·208
Copper (galvanoplastically precipitated),	−0·244
Cadmium (a strip of foil from Prof. Böttger),	−0·332
Antimony (commercial, pressed wire),	−1·897
Strontium (pressed wire),	−2·028
Lithium (pressed wire),	−3·768
Arsenic (a piece, pure),	−3·828
Calcium (pressed wire),	−4·260
Iron (piano-forte wire No. 4),	−5·218
Antimony (axial),	−6·965
" (equatorial),	−9·435
Red phosphorus (from Prof. Schrotter, from the Collection of the Heidelberg Chemical Laboratory),	−9·600
Antimony (purified as above),	−9·871
An alloy of 12 parts of bismuth and 1 part of tin,	−13·670
" 2 " antimony and 1 part of zinc,	−22·700
Tellurium (from M Alexander Loewe, purified by M. Holtzmann),	−179·80
Selenium (from the Collection of the Heidelberg Chemical Laboratory),	−290·00

The method by which these determinations were made is the following:—Two thermo-elements, whose warm and cold soldering points had the same temperatures, were compared with each other; these formed a circuit with the coil of a multiplicator, which surrounded a magnet rod (of about a pound weight), to which was fastened a piece of looking-glass, thereby allowing the deflexions of the magnet to be

observed at a distance by means of a telescope and scale, in the same manner as observations are made with the magnetometer. Two commutators were also brought into the circuit; the one changed the direction of the current in the wire of the multiplicator, the other allowed the currents of the thermo-elements to pass either so as to strengthen, or so as to oppose each other.

The foregoing experiments were carried out in the Physical Cabinet at Heidelberg, under the direction of Prof. Kirchhoff, to whose advice and assistance I am much indebted.

Solar Eclipse of March, 1858.

M. Quetelet at Brussels, carefully observed two compensating pendulums, in comparison with a chronometer, during the eclipse. The object was to see whether their vibrations were slower, as Professor Zantedeschi thought would be the case. The two pendulums were arranged so as to vibrate, the one parallel, the other perpendicular to the meridian. The one parallel to the meridian showed no change, but the other showed a loss of more than a second and a quarter per hour during the eclipse. The record of observations made several times a day for several days, both before and after the eclipse, show that this was no accidental coincidence; but many more observations will be necessary to establish the connexion of effect and cause between it and the eclipse.

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*On the Fixation of Metallic Sulphurets in Cotton-printing.** By Dr. H. Sacc.

The number of metallic colors employed in calico printing is so small, that there is sufficient inducement to seek for new ones, as fashion daily requires patterns of more varied colors and more effect in the coloration.

Hydrated oxide of iron, manganese bistre, oxide of chrome, chromate of lead, ultramarine-blue and green, Schweinfurt-green, copper-iron green, and the sulphurets of arsenic and antimony are probably all the mineral dyes which are employed in calico printing. Their use is, however, very limited, because some of them are difficult of fixation and others furnish unattractive tints; for this reason the reddish yellow, the sea-green from oxide of chrome, and the colors fixed by white of egg are almost the only ones of the above-mentioned group which are still employed. From the circumstance that these colors are fixed with difficulty, the following experiments were made, with the view of fixing metallic colors upon calicoes by means of a current of steam.

Numerous attempts to fix solid, colored metallic sulphurets of characteristic and fine tints upon the fibre proved failures; but satisfactory results were obtained by preparing the hyposulphites of those heavy metals whose sulphurets are not attacked by the weaker acids, such

* From the London Chemical Gazette, No. 381.

as cadmium, nickel, copper, lead, and mercury. Sulphuret of bismuth, protosulphuret and persulphuret of tin, and sulphuret of antimony were not adapted for this process, because the soluble salts of these metals are decomposed immediately when they are brought into contact with an alkaline hyposulphite, and thrown down in the form of perfectly insoluble sulphurets.

It is necessary that the metallic sulphuret should be formed upon the stuff itself, so that it must be employed in the form of a hyposulphite either in solution, or at least suspended; consequently, if the mixtures have been standing too long they become useless, because the metallic sulphuret is then already formed. After many trials the following proportions of the metallic salt and hyposulphite of soda proved to be the best.

It is to be noted preliminarily that the solution of gum contains 1 kilogrm. of gum in the litre of water, and the solution of hyposulphite of soda, 200 grms. of the solid salt in the litre.

Cadmium-yellow.—¼ litre of solution of gum is heated with 40 grms. of perchloride of cadmium, and ¼ litre of solution of hyposulphite of soda is added to the solution; the mixture is printed, steamed, and washed. It furnishes a very beautiful, solid, but unfortunately rather expensive yellow, which is but little changed even in the madder-bath.

Copper-green.—¼ litre of solution of gum is mixed with 25 grms. of sulphate of copper; the latter is dissolved by the aid of heat, and then ¼ litre of hyposulphite of soda is added. This green is very fine, and may be put into the madder-bath without undergoing any alteration; it is very uniform (when printed on a white ground it is better thickened with leicome than with gum), but it has the disadvantage, that when printed in warm weather it soon fades.

Nickel-gray.—¼ litre of solution of gum, 25 grms. of protochloride of nickel, and ¼ litre of hyposulphite of soda.

Lead-gray.—¼ litre of solution of gum, 25 grms. of nitrate or 50 grms. of acetate of lead, and ¼ litre of hyposulphite of soda. This gray may also be placed in the madder-bath without injury; the nickel gray acquires a somewhat lilac color by this treatment.

Mercury-gray.—¼ litre of solution of gum, 10 grms. of perchloride of mercury, and ¼ litre of hyposulphite of soda; or, to form chlorosulphuret of mercury, 50 grms. of perchloride of mercury instead of 10 grms.

These latter colors are very solid, but not easily prepared. The experiments will be further continued.—*Schweizer, Polytechn. Zeitschrift*, 1857, Bd. II. p. 175.

Photography on Iron.

M. Van Monchaven introduces with the collodion a proto-salt of iron, which forms in the silver bath a reducing agent, which, by its slow decomposition, gives peculiar rapidity to the process. The plates are very thin; they are simply sheets of Swedish iron varnished by heat with a bituminous mixture. The idea appears to be American, but the merit resides in the perfection of the work.—*Cosmos.*

For the Journal of the Franklin Institute.

Particulars of the Steamboat Serchil.

Hull and machinery built by Boardman, Holbrook & Co. Owners, Louisiana Tehuantific Co.

HULL.—

Length on deck,	140 feet.	
Breadth of beam (molded),	34 "	6 inches.
Depth of hold,	5 "	6 "
Draft of water,	2 "	
Tonnage,	215.	
Speed in knots,	12.	
Masts,—one.		

ENGINES.—Inclined direct.

Diameter of cylinders, two,		18 inches.
Length of stroke,	6 feet.	
Maximum pressure of steam in pounds,	75.	

BOILERS.—Two—Horizontal tubular.

Length of boilers,	20 feet	4½ inches.
Breadth "	5 "	
Height " exclusive of steam chimney,	7 "	
Weight of " without water,	32,000 lbs.	
Number of furnaces,—one.		
Breadth "	4 "	4 "
Length of grate bars,	5 "	
Number of tubes,	122.	
Internal diameter of tubes,		2¾ "
Length of tubes,	15 "	
Diameter of smoke pipe,	2 "	6 "
Height "	24 "	
Draft,—natural.		
Consumption of coal per diem,	8 tons.	

PADDLE WHEELS.—

Diameter, over boards,	18 feet.	
Length of blades,	5 "	
Depth "		14 inches.
Number "	18.	

Remarks.—Frames, sketch of shape,]. Depth, 3 inches. Width of web, $\frac{5}{8}$ in. Thickness of plates, $\frac{3}{8}$ to $\frac{3}{16}$-inch. Diameter of rivets $\frac{3}{4}$-in.; distance apart, 2½ inches; single riveted. One independent steam, fire, and bilge pump. Three bulkheads. Water bottom to boilers. One longitudinal bulkhead for entire length and breadth. C. H. H.

Protection of Plants from Frost.

M. Boussingault has devoted a long article in the *Annales de Chimie et de Physique* to the preservation of plants from frost, by filling the air with smoke. This is not recommended on nights when the thermometer at a distance above the soil indicates a temperature below 32°, for it would then have no effect; nor on windy nights, for then there is no frost; but it may possibly be found of service in protecting fruit-trees and delicate plants from the late frosts of spring, by which their blossoms are so often destroyed. Is it not, at any rate, worth trying?

*Poison in Paper-Hangings Colored with Arsenite of Copper.**

By G. PHILLIPS.

In the "*Pharmaceutical Journal*" for February last, it is stated that Dr. Halley, of Harley street, had detected arsenious acid in the atmosphere of his study, the walls of which were covered with green paper, and that the test he employed was "sheets of paper soaked in a solution of ammonia-nitrate of silver," and that upon this paper were deposited numerous well defined crystals of arsenious acid, visible under a low power with the microscope, and that the form of these crystals precluded the possibility of a mistake.

Ammonia-nitrate of silver is a test for arsenious acid, but not in the manner which Dr. Halley seems to suppose, as it does not cause the deposition of crystals of arsenious acid (which are colorless), but produces a bright yellow precipitate of arsenite of silver, provided the amount of ammonia present in the test be very exactly proportioned to that of the nitrate of silver; if such be not the case, no precipitate is produced. These particulars are mentioned because Dr. Halley appears not to have resorted to any other test, but to have concluded merely from the appearance of the crystals formed on his test paper, and without analyzing them, that they must be those of the poison in question.

In the following experiments, made with a view to test Dr. Halley's conclusions, the interior surfaces of two closets were covered with a green paper-hanging. One of the closets had a capacity of 17 cubic feet, and was lined with about 48 square feet of the paper, or 2·8 sq. feet to each cubic foot of space. The other closet had a capacity of 26 cubic feet, and was lined with 53 square feet of paper, or 2·0 square feet to each cubic foot of space.

These closets had no means of ventilation beyond the chinks round the doors; the included air, therefore, would remain much longer in contact with the paper than would be the case in an ordinary room. The surface of the paper to the bulk of air inclosed was not less than 14 times as great as it would be in a room 20 feet square and 12 feet high, thus showing that the conditions of the experiments were highly favorable to the impregnation of the air with arsenious acid, if such were possible. In each of these closets were placed two basins, one containing a solution of potash, the other ammonia-nitrate of silver, and a sheet of paper saturated with the latter re-agent. The smaller closet was kept as much as possible from the influence of common gas; but in the larger closet gas was allowed to burn during the day time, the temperature of the included air being kept by the flame at from 74° to 82° Fahr. The closets were carefully closed for 72 hours, the gas burning during that time 45 hours in the larger closet. The solutions of potash and ammonia-nitrate of silver from each closet were then examined by Marsh's test, which is by far the most delicate known, and found to be quite free from arsenic.

* From the Lond. Civ. Eng. and Arch. Journ., Aug., 1858.

The sheets of paper saturated with ammonia-nitrate of silver were also free from arsenic, but had on their surface numerous colorless crystals, which, when analyzed, proved to be nitrate of silver, the evaporation of the water from the test paper having concentrated the solution with which the paper was saturated to such an extent as to cause the nitrate of silver to crystallize out. On the test paper was also found an amorphous substance having a dingy yellow color, which speedily became black on exposure to light; the same substance was also observed on the surface of the ammonia-nitrate of silver contained in the basins, being most abundant in that which had remained in the closet in which gas had been burnt. When analyzed it was found to be sulphide of silver, the sulphur no doubt having been derived from the atmosphere of the laboratory, which always contains traces of sulphureted hydrogen. This dingy yellow substance, which, without analysis, might be supposed by some to be arsenite of silver, was formed in a third closet in which no arsenical compounds were present, thus proving that the green paper had no share in its production.

The green paper used in the experiments is colored with what is known as emerald or Schweinfurt green, which is a compound of arsenite of copper and acetate of copper. The paper contains 11·8 grains of arsenious acid to the square foot.

The following conclusions may fairly be drawn from the experiments above described:—

1. That even when a small bulk of air is allowed to remain, for a considerable time, in contact with a large surface of the arsenical paper, and that too at a temperature of 80° Fahr. not the slightest trace of arsenious acid is diffused in the air. Still less might the air of an ordinary room which occupies a large space in proportion to the surface of the walls, and which is being constantly changed by ventilation, be expected to become contaminated by the poison.
2. That the products of the combustion of gas do not facilitate the liberation of arsenious acid from the surface of the green paper.
3. That arsenious acid is not volatilized from the surface of such paper except at temperatures too high for human endurance.

It is probable that persons may have been affected by inhabiting rooms papered with arsenical hangings, not because the arsenious acid has been volatilized, but from the improper and frequent sweeping of the walls, by which minute particles of arsenite of copper might be detached from those portions of the surface of the paper which were not glazed, and becoming dispersed in the air, might be inhaled by persons occupying the room at the time. This only source of danger, which might be obviated by a little management in the cleaning of a room, and caution in the selection of a paper having but little of its surface unglazed, appears not to have presented itself to the mind of Dr. Halley, who seems to have been possessed with the idea that injury to health was to be apprehended solely from the vaporization of the arsenious acid. Dr. Taylor, on the other hand, ascribes the dan-

ger to the fact that the color is "put on very loosely," and, therefore, by inference, easily detached and disseminated through the air, not as vapor of arsenious acid, but as minute particles of arsenite of copper.

The subject under consideration being one of much importance, I have felt it necessery to enlarge upon it, and as Dr. Halley's statement is calculated to create an apprehension of danger which I believe has no existence, I beg to make the following remarks:

Dr. Halley states that on two occasions distinct crystals of arsenious acid were deposited on the surface of his test paper from the air of his room; it is more than probable that if he had analyzed the crystals, and not assumed their composition from their appearance under the microscope, he would have found them to be nitrate of silver. The test paper which he used had no more effect in causing the deposition of crystals of arsenious acid than any other surface in the room would have, and to suppose that crystals of the poison were thus deposited would be to imply that the air was impregnated with arsenious acid to an extent which must be fatal to persons inhaling it for a short time. Notwithstanding his statement that the air of his room furnished crystals of arsenious acid, he subsequently says that at ordinary temperatures with common atmospheric air, even when an aspirator was used, the amount of arsenic given off was "inappreciably small," omitting to mention what test he employed to detect a quantity not appreciable. The purport of his remarks, however, appears to be that arsenious acid to an appreciable extent, is only given off from arsenical paper in rooms in which gas is burnt, and that the products of the combustion of the gas *combine* with the arsenic in the paper. If such be the case, it is difficult to conceive how the arsenious acid can be deposited from the air of the room in a *free* and crystalline state.

It may be proper to mention that I and my family occupied a sitting-room three years, the walls of which were covered with paper heavily laden with arsenite of copper, and that for the same period my bed-room was also papered with arsenical hangings, yet neither I nor any member of my family experienced the slightest ill effect from such paper.

In conclusion, I beg to express my opinion that no danger need be apprehended from such papers, in which but a small proportion of the surface is unglazed, provided ordinary care be used when removing the dust from the walls, and that even if such care were not exercised it is doubtful whether any pernicious effects would be felt by those inhabiting the room.

Unwholesomeness of Lights.

Recent experiments have proved that lights of equal intensity obtained from different materials, require very different lengths of time to generate the same quantity of carbonic acid. The following is the relative time required by the common materials: Olive oil, 72 minutes; Russian tallow, 75; common (French) tallow, 76; whale oil, 76; stearic

acid, 77; wax candles, 79; spermaceti, 83; gas from common coal, 98; gas from fat or cannel coal, 152 minutes. Coal gas, therefore, and especially gas from cannel coal, is the least unhealthy of all ordinary lights; which is contrary to the usual opinion.—*Cosmos, June,* 1858.

[Here, there is no opinion unfavorable to gas on account of unhealthiness, because uncommon care is taken in this city to have it thoroughly purified; but in Paris, the popular opinion is right, for there the gas contains so much sulphur in various combinations as to be decidedly both unhealthy and offensive when burned in rooms. The above experiments, which teach only the quantity of carbonic acid generated, in no way contradict the common opinion there formed. Ed. *Fr. Jour.*]

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*Improvement in Producing Gas.**

M. J. Alphonse, miner, and F. Canal, Paris, have obtained "provisional protection" for an invention which consists in the use of tar and other residues arising from the manufacture of gas and other tars, resinous, or fatty matters, mixed with thin shavings, or chips, or pieces of wood, and saw-dust of all kinds of wood. This mixture is distilled in ordinary gas apparatus, and the gas resulting purified by ordinary means. By this process a very pure and cheap gas is obtained of good lighting power. The proportions of the various substances employed, are as follows:—

500 parts of the residue of gas or of fatty matter.
1000 parts of saw-dust of any kind of wood.
500 parts of shavings, chips, or pieces of wood of any kind.

In the various experiments it has been found these proportions are very suitable, but these can be varied according to the nature of the residue, or resinous, or fatty matter, according to the saw-dust and chips at the manufacturer's disposal, and also according to the quality of gas to be produced.

Note on the Measurement of Gases in Analysis.† By A. W. Williamson, Ph. D., F.R.S., Prof. of Chemistry in University College, and W. J. Russell, Ph. D.

In Bunsen's admirable method of gas analysis, considerable time and trouble are expended in observing the exact temperature and pressure to which the gas is subjected at the time of measurement; and also in calculating from these data the volume which the gas would occupy at the normal temperature and pressure. Frankland's excellent apparatus, on the other hand, protects the gas from the influence of variations of atmospheric pressure, and, under favorable conditions, even from the influence of change of temperature; but the complication of this apparatus, and its liability to derangement, seem likely somewhat to limit its use.

* From the London Mining Journal, No. 1194.
† From the London Chemical Gazette, No. 377.

If, when a fall of temperature takes place, we could diminish the pressure on the gas exactly in proportion to the diminution of elasticity which it undergoes, such fall of temperature would evidently not alter the volume of gas in the eudiometer. In like manner a rise of temperature might, if known, be counteracted by lowering the eudiometer-tube. The same remarks apply to variations of barometric pressure; as an increase of this influence might be counterbalanced by raising the eudiometer, and a diminution by depressing it.

It is therefore a question of some interest to find, for any atmospheric temperature and pressure, at what height of the eudiometer the enclosed gas will occupy the same volume as at the normal temperature and pressure. This is easily found by introducing a standard quantity of air into a tube over mercury, marking off the height of the mercury in the tube at the normal temperature and pressure; then, at any other temperature or pressure, raising or lowering the tube in the mercurial trough so as exactly to bring the enclosed air to its normal volume. The mercurial pressure needed for this purpose is evidently the same as that needed under the same circumstances for the reduction of any quantity of gas to the volume which it would occupy at the normal temperature and pressure.

The apparatus we use in applying this principle to gas analysis consists essentially of the ordinary Bunsen's eudiometer, and a "pressure tube," which is simply a tube of some 6 or 7 inches in length and about the diameter of an ordinary eudiometer. It is closed at one end, and to the other is fixed a smaller tube of about the same length. Such a quantity of air is introduced into this pressure-tube, that when it is inverted in the trough the mercury stands at a convenient height in the narrow tube. At this point a mark is made, which indicates the height of mercury needed at any temperature or pressure to reduce the enclosd air to its original volume. The mercurial trough which we have used differs only from the ordinary one in being provided with a well at one end, thus enabling the operator to raise or depress the eudiometer at pleasure, so as always to bring the gas which it contains to the same pressure as the air in the pressure-tube. Both the eudiometer and the pressure-tube are held in a perpendicular position by means of clamps which slide on upright rods. Each clamp is provided with a simple kind of slow movement, by which the tube can be raised or lowered by the operator whilst he is looking through a horizontal telescope at a suitable distance. We place the pressure-tube in front of the eudiometer, and by means of the fine adjustment bring the column of mercury in the small tube exactly to the normal mark. The eudiometer is then adjusted, also by means of the slow movement, so that the top of its meniscus (as seen through the horizontal telescope) exactly coincides with the top of the meniscus in the pressure-tube. This is easily done; for the diameter of the pressure-tube is considerably smaller than that of the eudiometer, and the meniscus in the latter can be clearly seen on both sides of the meniscus in the pressure-tube.

By this method we are able to obtain very accurate results with considerably less trouble than by Bunsen's method, and also without having

any calculations to perform. The following analysis made during very stormy weather, of air deprived of its carbonic acid by potash, gave results amongst which the greatest difference was only four hundredths of a per cent. (·04).

I.		
Volume of air taken,		144·81
After addition of hydrogen,		234·50
After explosion,		144·00
Nitrogen,	79·168	
Oxygen,	20·832	
	100·000	
II.		
Volume of air taken,		139·55
After addition of hydrogen,		229·07
After explosion,		141·89
Nitrogen,	79·176	
Oxygen,	20·824	
	100·000	
III.		
Volume of air taken,		148·1
After addition of hydrogen,		236·04
After explosion,		143·30
Nitrogen,	79·139	
Oxygen,	20·861	
	100·000	
IV.		
Volume of air taken,		149·14
After addition of hydrogen,		248·57
After explosion,		155·28
Nitrogen,	79·150	
Oxygen,	20·850	
	100·000	

We are still engaged in experiments on this and some other points of gas analysis, and hope to have the honor of communicating our results before long.

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*Professor Forbes on some Properties of Ice near its Melting Point.**

Prof. Forbes has communicated to the Royal Society of Edinburgh the results of some experiments made by him on the properties of ice near its melting point, with particular reference to those of Mr. Faraday, published in the *Athenæum* for June 1850, to which attention has been more lately called by Dr. Tyndall and Mr. Huxley in relation to the phenomena of glaciers. The substance of Prof. Forbes' statement is as follows:—

"Mr. Faraday's chief fact, to which the term 'regelation' has been more lately applied, is this, that pieces of ice, in a medium above 32°, when closely applied, freeze together, and flannel adheres apparently by congelation to ice under the same circumstances.

* From the Lond. Athenæum, Aug., 1858.

"1. These observations I have confirmed. But I have also found that metals become frozen to ice when they are surrounded by it, or when they are otherwise prevented from transmitting heat too abundantly. Thus a pile of shillings being laid on a piece of ice in a warm room, the lowest shilling, after becoming sunk in the ice, was found firmly attached to it.

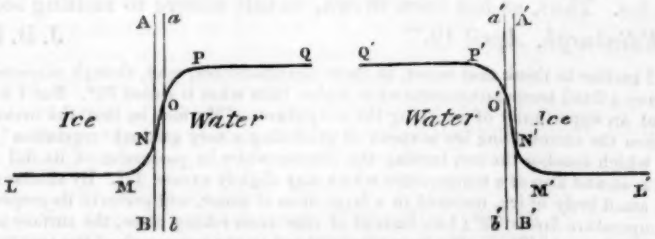
"2. Mere *contact*, without *pressure*, is sufficient to produce these effects. Two slabs of ice, having their corresponding surfaces ground tolerably flat, were suspended in an inhabited room upon a horizontal glass rod passing through two holes in the plates of ice, so that the plane of the plates was vertical. Contact of the even surfaces was obtained by means of two very weak pieces of watch-spring. In an hour and a half the cohesion was so complete, that, when violently broken in pieces, many portions of the plates (which had each a surface of 20 or more square inches) continued united. In fact, it appeared as complete as in another experiment where similar surfaces were pressed together by weights. I conclude that the effect of pressure in assisting 'regelation' is principally or solely due to the larger surfaces of contact obtained by the moulding of the surfaces to one another.

"3. Masses of strong ice, which had already for a long time been floating in unfrozen water-casks, or kept for days in a thawing state, being rapidly pounded, showed a temperature of 0·3° Fahr. below the true freezing point, shown by delicate thermometers (both of mercury and alcohol), carefully tested by long immersion in a considerable mass of pounded ice or snow in a thawing state.

"4. Water being carefully frozen into a cylinder several inches long, with the bulb of a thermometer in its axis, and the cylinder being then gradually thawed, or allowed to lie for a considerable time in pounded ice at a thawing temperature, showed also a temperature decidedly inferior to 32°, not less, I think, than 0·35° Fahr.

"I think that the preceding results are all explicable on the one admission, that Person's view of the gradual liquefaction of ice is correct (*Comptes Rendus*, 1850, Vol. xxx. p. 526)*, or that ice gradually absorbs latent heat from a point very sensibly lower than the zero of the centigrade scale.

"I. This explains the permanent lower temperature of the interior of ice.



"Let A B be the surface of a block of ice contained in water at what is called a freezing temperature. That temperature is marked by the

*Quoted by me in 1851, in my sixteenth letter on Glaciers.

level of the line Q P above some arbitrary zero. L M is, in like manner, the permanent but somewhat lower temperature possessed by the interior of the ice. The space, partly water, partly ice, or partaking of the nature of each, M N O P, has a temperature which varies from point to point, the portion N O corresponding to what may be called the physical surface of the ice between A B and *a b*, which is 'plastic ice,' or 'viscid water,' having the most rapid variation of local temperature.

"II. Such a state of temperature, though it is in one sense permanent, is so by compensation of effects. Bodies of different temperatures cannot continue so without interaction. The water *must* give off heat to the ice, but it spends it in an insignificant thaw at the surface, *which therefore wastes even though the water be what is called ice cold*, or having the temperature of a body of water inclosed in a cavity of ice.*

"The waste has yet to be proved; but I have little doubt of it; and it is confirmed by the wasting action of superficial streams on the ice of glaciers, though other circumstances may also contribute to this effect.

"III. The theory explains 'regelation.' For let the second plane surface of ice A′ B′ be brought up to nearly physical contact with the first surface A B. There is a double film of 'viscid water' isolated between two ice surfaces colder than itself. The former equilibrium is now destroyed. The films A B *b a* and A′ B′ *b′ a′* were kept in a liquid or semi-liquid state by the heat communicated to them by the perfect water beyond. That is now removed, and the film in question has ice colder than itself on both sides. Part of the sensible heat it possesses is given to the neighboring strata which have less heat than itself, and the intercepted film of water in the transition state becomes more or less perfect ice.

"Even if the second surface be not of ice, provided it be a bad conductor, the effect is practically the same. For the film of water is robbed of its heat on one hand by the colder ice, and the other badly-conducting surface cannot afford warmth enough to keep the water liquid.

"This effect is well seen by the instant freezing of a piece of ice to a worsted glove even when on a warm hand. But metals may act so, provided they are prevented from conveying heat by surrounding them with ice. Thus, as has been shown, metals adhere to melting ice.

"*Edinburgh, April* 19." J. D. F."

* "I incline to think that water, in these circumstances, may, though surrounded by ice, have a fixed temperature somewhat higher than what is called 32°. But I have not yet had an opportunity of verifying the conjecture.—[My idea is, that the invasion of cold from the surrounding ice is spent in producing a very gradual 'regelation' in the water which touches the ice, leaving the interior water in possession of its full dose of latent heat, and also of a temperature which may slightly exceed 32°. By similar reasoning, a small body of ice, inclosed in a large mass of water, will preserve its proper internal temperature *below* 32°; but, instead of regelation taking place, the surface is being gradually thawed. This is the case contemplated in the paragraph of the text to which this note refers.]"

N. B.—The words in brackets were added to this note during printing. 13th May, 1858. J. D. F.

Telescopic Mirrors.

M. Leon Foucault appears to have introduced a very great improvement in the art of making mirrors for telescopes, by constructing them of glass in place of metal. He finds that a true parabolic figure may be easily and rapidly given, and the much greater stiffness and elasticity of the glass prevents the deformation of the mirror when the plane of the opening is vertical. The reflecting surface is of silver deposited on the glass galvanically—and no better idea can be given of the excellence both of the figure and polish, than by repeating his statement that by means of a mirror thus made of 33 centim. (13 inches) opening, and 2·25 metres (7·38 feet) focal length, he was enabled to see the star γ Andromedæ triple, which no refractor less perfect than the great Pulkova instrument is able to show.—*Cosmos, August* 6, 1858.

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*Waterglass, as a Preservative of Materials.**

We are anxious from time to time to lay before our readers somewhat *in extenso* the particulars of such aids to art productions and their preservation as it may fall to our lot to investigate; believing, that though the means of conducting certain inquiries may not be altogether perfect, and thus we may occasionally arrive at overstrained conclusions, we are advancing rather than retarding the interests of practical science when we adduce, to the best of our ability, such materials for further experiments as circumstances may enable us to glean.

A few months since a considerable space was devoted in our *Journal* in exemplifying the process employed by Mr. Poole in endeavoring, by certain chemical means ingeniously applied, to arrest the progress of decay in the monumental remains in Westminster Abbey; we now purpose to treat of another preparation, largely used on the Continent, for which various and important qualities are claimed, and the correctness of which it is desirable to ascertain; that if confirmed, so valuable a medium should secure its speedy recognition far and wide.

Waterglass is a preparation in which silica is a large ingredient, the composition resembling that of ordinary glass, only that it is soluble in water. The various properties it contains (under different modifications) may be stated as follows: A solution of Waterglass, painted on any substance which is not too porous, dries very rapidly, and forms a shining varnish, possessing great durability, more particularly when it has been mixed with certain pulverized substances, colors, &c.; these paints will undergo no change either of atmospheric influence, moisture, weak acid, or by the action of fire. Experiments, with the view of testing these last qualities, were lately made at Chatham,—under the direction of Lord Panmure,—on large huts, painted inside and out with Waterglass in combination with lime wash, which satisfactorily retarded the effects of fire and moisture.

Waterglass applied to porous substances, as stone, wood, &c., pene-

* From the London Civ. Eng. and Arch Jour., September, 1858.

trates partially into the pores, and forms a chemical combination with them.

The silica, as a component, has the property of combining with lime and similar substances, and of forming with the mortar or stone a hard cementing power. The formation of the new and insoluble silicate will be accelerated in proportion to the atmospheric air admitted, the carbonic acid of the atmosphere having a beneficial influence. In proof of this it appears that a piece of common chalk, immersed for a time in this solution, and afterwards dried, will become as hard as stone; whence it is inferred that a mixture of finely powdered chalk with Waterglass will form a cement of unusual hardness.

This medium is prepared in four degrees of strength, according to the several requirements for its application, viz: from a weak solution, which is most generally useful, to a thick syrupy consistence, which is principally useful as a cementing agent. For the hardening of stone or cement, and preserving them from damp and decay, the thin mixture is applied to the surface several times, allowing a sufficient interval between each application for drying (about half an hour suffices for this), and the coatings should be continued till the liquid is no longer absorbed by the stone, &c., and a good surface is acquired. It is recommended that the applications of simple solution and paints be not laid on too thick, frequent and thin coats being better, although it is desirable that not too many coatings should be given, so as to produce a glassy surface, since this might interfere with its durability. A good ground material for working on, when stone is not used, is mortar composed of lime and sand. This is particularly important for artistic works, and the new method of fresco painting known as Stereochromy.

Wood, coated with a solution of Waterglass, assumes a darker shade, somewhat similar to the effect of nitric acid on it,—the fluid penetrating the pores, and forming on the surface a glassy impermeable coating calculated to resist the influence of fire, air, and damp. Other substances, more or less inflammable, may thus it is presumed be protected from fire. Paper-hangings particularly, which can also be washed with soap without injury, decorations for theatres, &c., linen, cloth, &c., may, it is asserted, be rendered thus fire-proof, while it is also a useful agent in protecting wood from moisture, fungus, and dry rot. The following is the process adopted. The timber is first slightly damped, and then put into a solution of green vitriol; and, when well saturated, immersed in a weak dilution of Waterglass. By this mode of treatment wood is almost silicated, and its durability greatly enhanced.

The introduction of Waterglass for calico printing, by Mr. Kuhlman, is an important item in its varied uses. This gentleman has compiled several interesting papers on it, which Messrs. Sicherer and Hausman intend to communicate at some future time.

It remains to direct such of our readers as are interested in the subject, but are not acquainted with the depot, to the "Metropolitan Waterglass Works," 17, Eastcheap, London; where more detailed information will be imparted than we have been able here to communicate.

*Lighting from Ceilings.**

A Venetian has invented a new apparatus for lighting theatres. By parabolic mirrors he concentrates the light over the opening in the ceiling, and they are reflected down on a system of plano-concave lenses, a foot in diameter, which occupy the aperture, and convey into the theatre the rays of light, which arrive at them parallel and depart from them divergent. It is said to be efficacious and very cheap, lighting the whole theatre. The system of lighting, exclusively from above, by reflectors, and in connexion with ventilation, has been extensively practised in churches, halls, and other public buildings throughout our own country, under the name of "sun-lights."

Photographic Enamels.

MM. Armengaud in the *Genie Industriel* announce that "the MM. Bruder, of Neufchatel, (Switzerland,) have discovered a process by which photographs may be developed on white enamel, incorporated by vitrification, and covered with a glaze of glass also melted and incorporated with the enamel. They apply the same process also upon metals and wood." M. l'Abbe Moigno, in the *Cosmos*, claims this invention for M. Lafont de Camarsac, and affirms that medallions, broaches, &c., ornamented in this way, may be found at the store of M. *Disderi, Boulevard des Italiens, No.* 8.

On the Rotation of a Metallic Sphere by Electricity.†

At a recent meeting of the Royal Society an ingenious and curious apparatus was exhibited, displaying the rotation of a metallic sphere by electricity. The apparatus was contrived by Mr. Gore, of Birmingham, who states that his experiments had their origin in a phenomenon observed by Mr. Fearn, of Birmingham, in his electro-gilding establishment—that a tube of brass half an inch in diameter and 4 feet long, placed upon two horizontal and parallel brass tubes, 1 inch in diameter, and 9 feet long, and at right angles to them, and the latter connected with a strong voltaic battery consisting of from 2 to 20 pairs of large zinc and carbon elements, the transverse tube immediately began to vibrate, and, finally, to roll upon the others. Acting upon this, Mr. Gore constructed a disk of wood provided with two brass rails, level, uniform, and equidistant; on these rails a hollow and very thin copper ball was placed, and the brass rails being connected with a zinc and carbon battery, the ball began to vibrate, and presently to revolve. In all cases yet observed, Mr. Gore states that the motion of the ball is attended by a peculiar cracking sound at the points of contact, and by heating of the rolling metal. When the apparatus was exhibited before the Royal Society, electric sparks were seen as the ball rolled from the spectator.

* From the Lond. Civ. Eng. and Arch. Journal, Oct., 1858. † From the Lond. Athenæum, July, 1858.

Abstract of Meteorological Observations for September, 1858; made in Philadelphia, Somerset, Bedford, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

September, 1858.	PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.									SOMERSET, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.						BEDFORD, Bedford Co. SAMUEL BROWN, Observer.			HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.			
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain.	Prevail'g winds.	Bar.	Ther.	Relative humidity.	Force of vapor.	Rain.	Prevail'g winds	Bar.	Ther.	Prevail'g winds.	Bar.	Ther.	Rain.	Prevail'g winds
	Mean.	Mean daily range.	Mean.	Daily oscillation.	Mean daily range.	2 P. M.	2 P.M.			Mean.	Mean.	2 P. M.	2 P.M.			Mean	Mean.		Mean.	Mean		
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.		Inch.	°	Per ct.	Inch.	Inch.		Inch.	°		Inch.	°	Inch.	
1	29·864	·075	73·5	20	0·7	51	·522		S W.	27·677	65·0	49	·456		W.	29·109	68·0	N W.	29·307	60·3		E.
2	29·806	·058	74·7	15½	2·2	52	·571		(var.)	27·629	66·3	49	·456		S W.	29·032	74·7	(var.)				S.
3	29·708	·098	79·8	19	5·2	61	·761	0·061	S.	27·548	70·0	69	·638	0·045	(var.)	28·957	73·0	(var.)	29·139	71·7	0·131	W.
4	29·687	·039	75·0	18	6·8	60	·676	0·467	N W.	27·543	65·0	63	·455	0·247	W.	28·933	67.7	S W.	29·133	68 7		S W.
5	29·775	·088	71·7	21	6·0	55	·584		S W.	27·628	61·3	55	·429		W.				29·234	66·7		N W.
6	29·897	·122	73·7	18	2·0	45	·472		S.	27·810	63·0	60	·540		(var.)	29·233	64·3	S W.	29·446	65·0		N.
●7	30·071	·141	75·0	23	1·3	41	·492		S W.	27·863	69·3	39	·409		S.	29·305	67·0	S E.	29·510	69·0		S.
8	30·044	·023	73·3	21	1·7	46	·519		S W.	27·832	70·7	43	·482		S.	29·253	69·7	(var.)	29·440	68·0		S.
9	29·998	·080	76·8	23	3·5	52	·662		S W.	27·761	74·3	54	·648		S.	29·172	72·0	(var.)	29 357	73·7		S.
10	29·875	·090	78·0	21	1·2	52	·662		S W.	27 659	73·0	55	·656	0·183	S W.	29·062	77·3	S W.	29·2.1	76·0	0·388	S.
11	29·792	·083	73·0	19½	8·3	81	·679	0·222	(var.)	27·622	63·0	51	·428	0·055	W.	29·017	67·0	N W.	29·220	68·0		N W.
12	29·827	·039	70·0	15	5·0	42	·388		WNW	27·683	57·7	41	·273		WNW							N W.
13	30·025	·198	65·7	19	4 3	47	·395		N E.	27·794	57·7	49	·370		S E.	29·261	57·3	(var.)	29·498	56·0		N.
14	30 061	·067	66·7	17	1·7	50	·408		E.	27·794	61·7	54	·442		(var.)	29·279	60·3	S E.				S.
☾15	29·812	·269	70·3	10½	3·7	76	·641	0·030	N E.	27·584	58·3	80	·510		S E	29 042	58·7	S E.	29·178	61·0	1·127	(var.)
16	29·403	·380	68·3	14	2·0	63	·531	0 696	N W.	27·334	56·3	94	469	0·065	WNW	28·758	61·7	N W.	28·888	61 7		N.
17	29·846	·443	63·7	16	4·7	49	·370		W.	27·735	53·7	65	·338		W.	29·156	60·3	N W.				W.
18	30·169	·323	63·7	21	1·3	34	·265		WNW	27·963	55·7	56	·397		WSW.	29·411	55·7	N W.	29·635	56·3		(var.)
19	30·192	·024	68·0	22½	4 3	46	·442		N W.	27·987	63·0	53	·513		W.				29·638	61·3		S.
20	30·141	·059	69·7	23	1·3	48	·509		S W.	27·960	65·7	60	·676		(var.)	29·369	67·3	S E.	29·559	66 3		S.
21	29·839	·302	74·7	26	5·2	55	·676		S W.	27·744	69·7	50	·516		(var.)	29·137	68·0	N W.	29·317	70·3		W.
○22	29·870	·135	60 0	25	14·8	38	·260		N W.	27·737	52·7	61	·288		NNW.	29·176	56·0	N W.	29·420	56·0		N.
23	29·997	·127	53·5	22	7·8	36	·201		N W.	27·806	49·3	57	·327		N W.	29·302	49 7	N W.	29·498	49·3	0·092	N W.
24	29·906	·096	56·5	13	5·0	76	·380	0·113	S W.	27·655	55 7	76	·364	0·149	(var.)	29·085	56·7	N W.	29·299	55·7	0·710	N.
25	30·069	·163	56 3	17½	4·2	39	·243		N E.	27 819	52·0	67	·282		E.	29·306	55 0	N W.	29·527	56·0		(var.)
26	30·146	·078	56·8	24	2·8	37	·244		N E.	27·876	56·0	48	·284		(var.)				29·586	51·7		E.
27	30·157	·025	59·5	24	2·7	35	·246		N E.	27·937	53·0	40	·258		E.	29·426	50·3	S E.	29·632			E.
28	30·053	·104	58·8	21	1·0	38	·260		N E.	27·828	55·7	48	·353		S W.	29·313	54·3	S E.	29·444	52·0		E.
☽29	29·882	·171	61 7	26	2·8	42	·344		(var.)	27·662	59·7	52	·469		WSW.	29·100	60·7	S E.	29 276	62·0		E.
30	29·752	·130	69·3	26	7·7	52	·546		S W.	27·576	70·7	52	·571		WSW.	28·976	71·7	S W.	29·122	66·3		S.
Means	29·992	·135	67·9	19·7	4·1	50	·465	1·589	s88½w	27·735	61 5	57	·443	1·344							2·448	

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